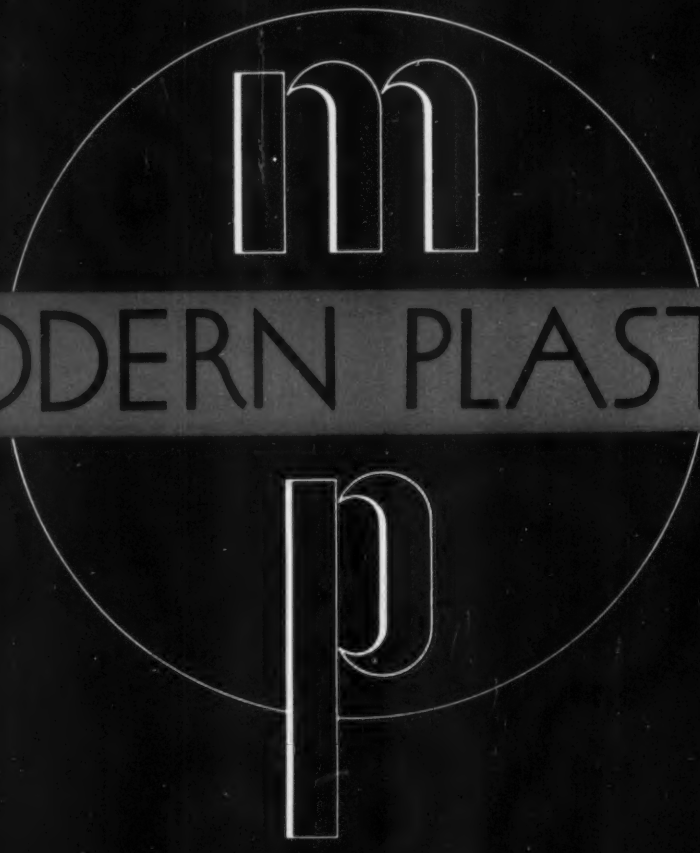

MODERN PLASTICS

APRIL 1953

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Durez now offers you a phenolic plastic molding material having an impact or shock strength in foot-pounds per inch (Izod) ranging up to 30.

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*Owens-Corning Fiberglas

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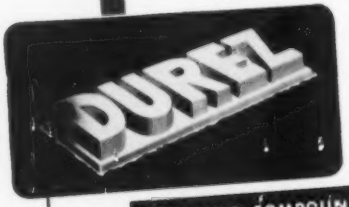

Member S. P. I. Committee on Large Plastics Moldings

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- MOLDING COMPOUNDS
- INDUSTRIAL RESINS
- PROTECTIVE COATING RESINS

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We, at Catalin, are not only proud of the appointment accorded CATALIN STYRENE in this instance, but welcome the opportunity to detail its superior properties to others of America's leading molders and marketers. Inquiries invited!

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MODERN PLASTICS*

APRIL 1953 VOL. 30, NO. 8

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EDITORIAL

How to Validate a Vision

This piece is being written in Washington, at the Reinforced Plastics Conference. The registration is 1442; companies represented number 437. Sessions are well attended. The exhibits are, to say the least, thrilling—particularly to anyone who has watched the growth of this young industry. Excitement about new things to be made from reinforced plastics is wide-spread.

But, somehow, one gets the impression of a mirage, of a pitch and volume of enthusiasm that is out of proportion to the immediate prospects of the industry.

Best educated guesses on the amount of polyester resins to be used in reinforced plastics in 1953 range from 27 million to 30 million pounds. Eighteen material makers are competing for that business, which represents a 50% poundage increase over 1952. Approximately 15 million lb. of fibrous glass will be used with that resin; seven glass makers are competing.

Obviously these companies, with large interests at stake, are not thinking in terms of the present year's markets. So the phenomenon is not a mirage, but a vision.

Many and big are the jobs yet to be done in reinforced plastics, especially in molded form. The automotive, furniture, business equipment, refrigeration, and home appliance fields have barely been opened. The industrial equipment field has big possibilities. The farm equipment and building construction fields are yet untouched. The whole field of transportation is going to need reinforced plastics.

The vision is valid.

But how soon, and how will it come to realization? A big part of the answer must come from the custom molders of reinforced plastics.

The question is: how many of them could handle big production if the business was offered? And the answer is: out of over 120 reinforced plastics custom molders only a few today are capable in capital strength, facilities, and experience to take on large-scale production of the quantity of molding which the above-mentioned fields will want.

Experience in older sections of the plastics industry shows that customers generally set up captive plastics plants only when forced to do so by lack of convenient custom facilities or by economics.

If reinforced plastics is to justify the vision presented at this eighth annual conference, more good-sized custom molding concerns will be needed. This may be accomplished by expansion of present molding concerns, entry of new enterprise into the industry, and amalgamation of smaller entities.

And the more rapid this expansion at custom molder level, the more rapid will be the growth of reinforced plastics.

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Quality at a fair price	An assurance that Thermatron gives you the best possible product at the lowest price compatible with high standards.
Economy of production	Enabling you to give your customer a product that is dependable and inexpensive.
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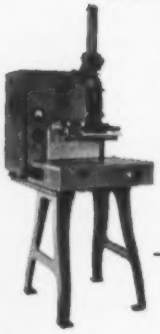

Standard Thermatron models from ¼ KW to 6 KW weld vinyl from .002" up to .080", serving most requirements . . . but if you have a new and special need, we can build to your specifications. Write us for our latest Bulletin No. 72.

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Size of die plates	21 x 25"
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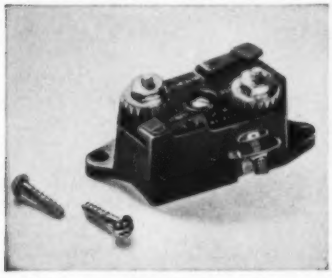

Lightning Arresters. High dielectric strength, high arc resistance and durability are characteristics of Celanese acetate.

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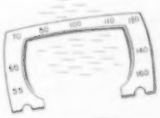

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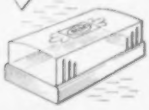

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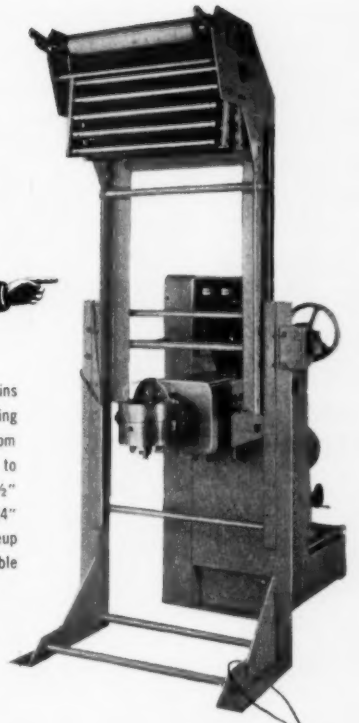

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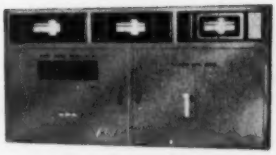

Three-zone temperature control

the W-S 16 OUNCE HORIZONTAL MOLDING MACHINE

Experience has shown that the day-to-day shirt-sleeve jobs are done most economically on the intermediate size machines—notably the famous W-S 16 ounce Injection Molder.

There's more than size, however, behind the outstanding preference for this model. Consider, for example, a single machine in which *all* these features are offered:

- Extra long heating cylinder for increased plasticizing efficiency . . . COMPARE!
- Three-zone temperature control . . . COMPARE!
- Replaceable bronze bushings in cylinder and moving platens...COMPARE!
- Faster cycles with dual pressure controls . . . COMPARE!
- Hydraulic and electric safety controls . . . COMPARE!
- Special pumping unit . . . COMPARE!
- Remote control panel . . . COMPARE!

If *your* profits are coming in something less than the full measure, it will pay you handsomely to investigate this profit-booster NOW. Detailed literature and/or personal analysis without obligation.

W-S HYDRAULIC

THE WATSON-STILLMAN COMPANY

DIVISION OF H. K. PORTER COMPANY, INC.

150 Aldene Rd., Roselle, New Jersey

Foreign Sales Representatives: OMNI PRODUCTS CORP., 460 Fourth Avenue, New York 16, N. Y.

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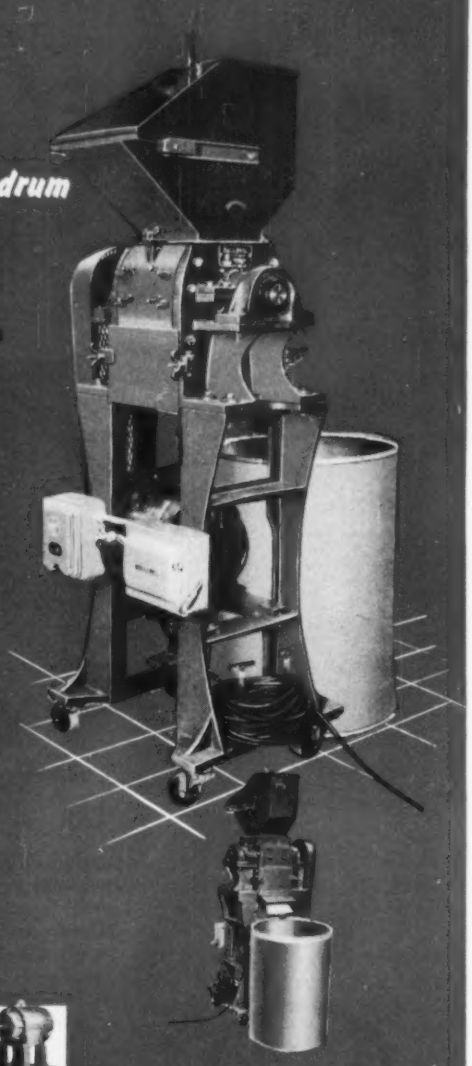
New-Improved LABORATORY "251" GRANULATOR

- granulates directly into any 30" drum
- takes less floor space
- large 8"x8" throat opening



One of the leading molders in the East dictated this new design. These new, improved features meet the requirements of every plant.

LESS FLOOR SPACE:—With work space at a premium, the LABORATORY "251" now takes an absolute minimum of floor space.

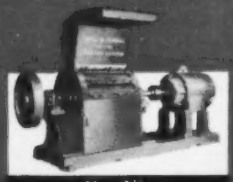
GRANULATES DIRECTLY INTO 30" DRUM:—Eliminates the necessity of transferring material from bin to drum. *This machine also provided with bin receptacle if desired.*

NEW HOPPER DESIGN:—Eliminates fly-back leakage.

These new advantages, plus sturdy construction make the LABORATORY "251" a superbly dependable machine. The 8" x 8" throat opening takes large sprues and runners, with a capacity of 100 to 150 pounds per hour. Standard screen furnished to meet your granule size requirement. The entire machine has been designed for easy accessibility to all parts. Hopper, screen, and chute are all removed quickly for cleaning. Delivered with or without casters.

There's a B & J machine for every need. Tell us your requirements and send samples of your material for grinding in our testing laboratory. Or write for brochure describing our many different size machines.

HEAVY DUTY IDEAL medium size machine for grinding tough, dense waste. Capacity up to 250 lbs. per hour. 5 H.P. motor.



No. 1½ for high production grinding. Capacity up to 1200 lbs. per hour. 20 or 25 H.P. motor.

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Leaders in Granulating Machinery for Half a Century

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Look for a 1-Track Mind...

For Results in Thermosetting Moulded Plastics

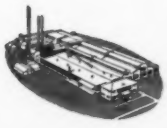
Your thermosetting jobs are set for a clear right-of-way here at Kurz-Kasch. Compression, transfer and plunger moulding methods are what we are set up for expressly—both physically and mentally. Idea, of course, is to deliver all the advantages of specialization and experience.

You want a moulder strong on tool control and production, too—and that's the second strong part of our system. Matter of fact, we've just finished adding more mould-making capacity to one of the finest toolrooms in the business.

If you have a thermosetting job (any of 'em including Teflon or moulded glass-filled polyesters) that track's pretty clear right now. If, on appraisal, the job you submit can be more effectively handled by other moulding methods, we'll be happy to recommend fellow-specialists in the proper fields. Call us—or one of our offices.

Kurz-Kasch

FOR OVER 36 YEARS PLANNERS AND MOULDERS IN PLASTICS



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Another development using

B. F. Goodrich Chemical *raw materials*

Don't miss it!
SEE THE B. F. GOODRICH CHEMICAL COMPANY EXHIBIT AT THE NATIONAL PACKAGING EXPOSITION . . . Booths 162-163.

Hycar-phenolic molding compound supplied by General Electric Company, Chemical Division, Pittsfield, Mass. Plug-in ballast molded by Plastic Products, Inc., Norwalk, Conn. B. F. Goodrich Chemical Co. supplies the Hycar American rubber only.

little plugs "take" big bumps WITH HYCAR!

THIS wall plug for a fluorescent lighting unit shows again how a Hycar-phenolic compound helped solve costly breakage problems. Formerly plugs like these couldn't stand many shocks. Breakage occurred when they took bumps from vacuum cleaners and other heavy objects—or from rough handling in assembly.

Because the design couldn't be changed, a tougher molding material had to be used. And the plug manufacturer found exactly what was needed in a Hycar-phenolic compound. It greatly strengthens the plugs. Now they come off the assembly line with minimum rejects—have far greater resistance to bumps from cleaners.

Hycar-phenolic compounds have many advantages. They impart extra toughness and shock-resistance that enable molded parts to withstand more than usual abuse. In processing, they provide better molding characteristics . . . easier flow in the mold than straight phenolics . . . resistance to cracking around metal inserts in the part.

One of the many Hycar rubber compounds may help you improve a product or develop new ones. For versatile Hycar is used as a base material . . . as a modifier for phenolic resins . . . as a plasticizer for polyvinyl resins . . . as an adhesive base . . . as a latex for coating or impregnating. For helpful technical advice, please write Dept. HV-2, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio. In Canada: Kitchener, Ontario. Cable address: Goodchemco.

B. F. Goodrich Chemical Company
A Division of The B. F. Goodrich Company

Hycar
Reg. U. S. Pat. Off.
American Rubber

GEON polyvinyl materials • HYCAR American rubber • GOOD-RITE chemicals and plasticizers • HARMON organic colors

Even Your "ORDINARY" Custom Molding Gets "SPECIAL" Consideration at Ideal

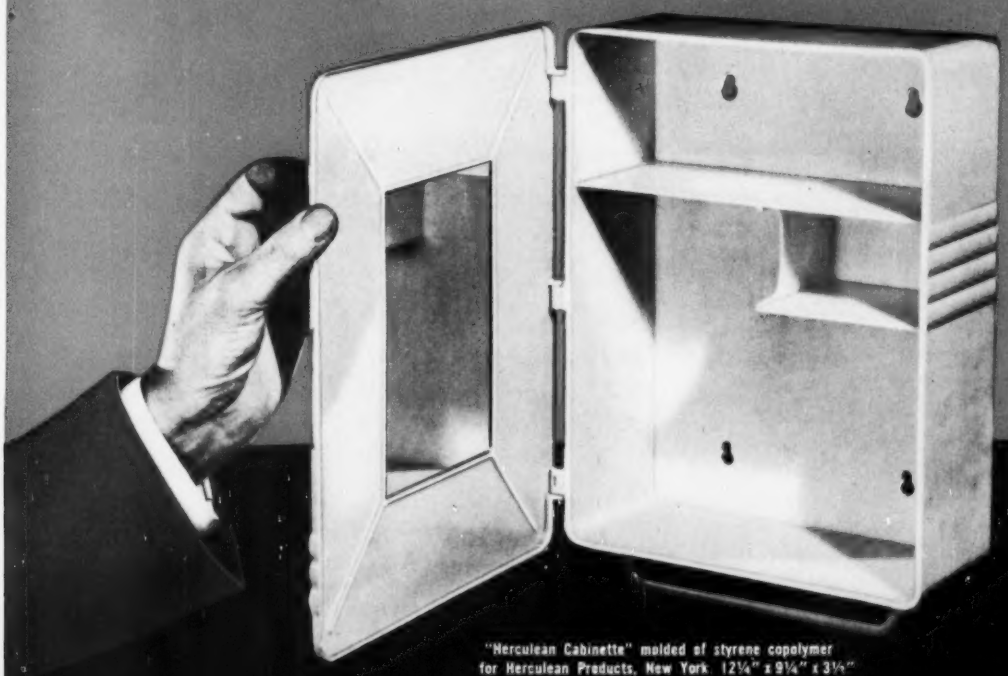
An analysis of the products Ideal custom molds would reveal that the majority of them are routine. Hobbing or machining the molds generally is uncomplicated, and the molding of the product does not tax our ability.

Ideal's major contribution to these "ordinary" jobs is the "special" consideration we give each phase of their production. Every possible avenue is explored to guarantee you the best combination of serviceability and low cost.

The design is checked for ease of molding and for reinforcement of sections which will undergo strain. Material selection is analyzed in terms of the use the product will get. Important questions are asked: Is there any place we can cut thickness to save material without affecting strength or utility? Can any part of the design be molded-in to reduce finishing costs? What can be done to simplify assembly? Will annealing be necessary?

The answers to these and scores of other similar questions help Ideal keep your costs down and make your products better.

Whether the production of your item is "ordinary" or complicated, the "special" treatment it will get at Ideal will insure your satisfaction. For full information on our unexcelled custom molding and fabricating service contact A. C. Manovill, Vice Pres. in Charge of Sales. IDEAL PLASTICS CORPORATION, 184-10 Jamaica Ave., Hollis 7, N. Y. Phone: AXtel 7-7000. Mid-West Representative: Steel Mill Products Co., 176 West Adams St., Chicago 3, Ill. Phone: CEntral 6-5136.



"Herculean Cabinette" molded of styrene copolymer for Herculean Products, New York. 12¼" x 9¼" x 3½"

Better Molded Plastics **Ideal** *for Industry & Home*

I.C.I. PLASTICS

Serve the Aircraft Industry

The prototype Comet II. *Photo. by courtesy of the De Havilland Aircraft Co. Ltd.*

There are few British aircraft in which I.C.I. plastics are not used somewhere, whether it be in the manufacture of radomes for night fighters, or p.v.c. fabric for the interior decoration of new airliners.
I.C.I. Plastics have contributed much to the success of the De Havilland Comet—the world's first jet airliner.

'Nuron', 'Perspex', 'Alkathene', 'Welvic', and 'Fluon' are Registered trade marks in the United Kingdom, the property of Imperial Chemical Industries Limited.

The plastics widely used in this aircraft are:

'NURON'—low pressure contact laminating resin used with glass cloth in the fabrication of large and small ventilation pipes, fume ducts, wing tips, fan casings, etc.

Advantages: simple and inexpensive fabrication, low weight of mouldings, toughness.

'PERSPEX'—acrylic sheet for pressurised cabin windows (including inner framing), lighting fittings, toilet fitments, accessories, etc.

Advantages: ease of fabrication, low weight, toughness, excellent weathering properties.

'ALKATHENE'—brand of polyethylene for radar cable insulation.

Advantages: low power factor, lightness in weight, ease of extrusion.

'WELVIC'—polyvinyl chloride for electric cable insulation.

Advantages: ease of extrusion, resistance to abrasion, available in non-inflammable grades, made in a wide range of colours for easy cable identification.

'FLUON'—polytetrafluoroethylene, a special high-frequency dielectric.

Advantages: unaffected by high temperature or corrosive fluids.

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Plastics Division, Welwyn Garden City, Herts, England
U.S.A. enquiries to **J. B. HENRIQUES, INC.**
521 Fifth Avenue, New York, 17 NY.

P.3338

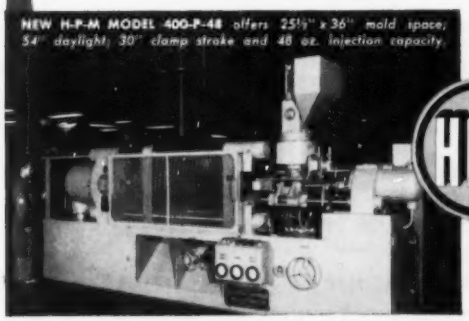
New

H-P-M's 48 oz. PRE-PLASTICIZER

- Deeper Draws
- Strain-free Parts
- Better Dry-Coloring
- Faster Cycles
- Lighter Weight Parts
- Less Part Distortion

"We are now operating 4 H-P-M Pre-plasticizing Machines, including the new 48 oz., and have another "48" on order. On machines larger than 12 oz., preplasticizing is a must for our business. We wouldn't buy anything else."

This 11" deep combination waste basket and garbage pail, molded in impact styrene, tells the story of H-P-M's new 48 oz. injection machine. No longer are giant machines required to make deep section parts. Here's a high-speed, medium size machine that will do the job for many thousands of dollars less and is versatile enough to handle smaller "shots", too. It's a pre-plasticizer . . . not a conversion unit . . . and gives the injection molder all the cost-saving advantages of pre-plasticizing . . . no chance of burning material . . . flat parts without distortion . . . more parts per hour . . . less weight per part . . . truer color blending . . . better finish . . . easier mold release. Yes, there's a multitude of reasons why you should investigate H-P-M's new 48 oz. pre-plasticizer. Write today for details!



NEW H-P-M MODEL 400-P-48 offers 25½" x 36" mold space, 54" daylight, 30" clamp stroke and 48 oz. injection capacity.

HPM

THE HYDRAULIC PRESS MFG. CO.

1010 Marion Road, Mount Gilead, Ohio, U. S. A.

make it Wellington Sears Duck

a superior fabric for laminating

For years laminators everywhere have recognized the superior quality of Wellington Sears ducks for reinforced plastics. A typical example is Wellington Sears single filling duck — a fabric with the right weight and rugged, hard-gripping texture to make an excellent reinforcement for C grade laminates where high impact strength is of first importance. Among its wide variety of applications are sheet stock and tubing as well as fabricated items such as safety helmets, heavy-duty gears and mechanical parts of many kinds.

Wellington Sears single filling ducks are available in widths of 29" and wider and in weights from about 8 oz. to 15 oz. per square yard.

Wellington Sears quality laminating ducks include "Superior"* army duck, chafer fabrics and numerous special constructions. You'll find additional fabrics for both coating and laminating listed at the right. Whatever your fabric problem —let's talk it over...call your nearest Wellington Sears office.

An illustrated 24-page booklet filled with valuable facts on fabric development and applications of interest to present and potential users of industrial fabrics is yours for the asking. Write for a free copy of "Modern Textiles for Industry" to Wellington Sears Co., Dept. **101-J,** *65 Worth Street, N. Y. 13.* *Reg. T. M.

Superior Fabrics for Coating and Laminating

- Single filling ducks
- Army ducks
- Single and plied-yarn chafers
- Special ducks
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- Twills
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- Sheetings
- Nylon, rayon and other synthetics
- Lantuck non-woven fabrics

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A SUBSIDIARY OF WEST POINT MANUFACTURING COMPANY

FIRST in Fabrics for Industry

WELLINGTON SEARS COMPANY, 65 WORTH STREET, NEW YORK 13, N. Y.

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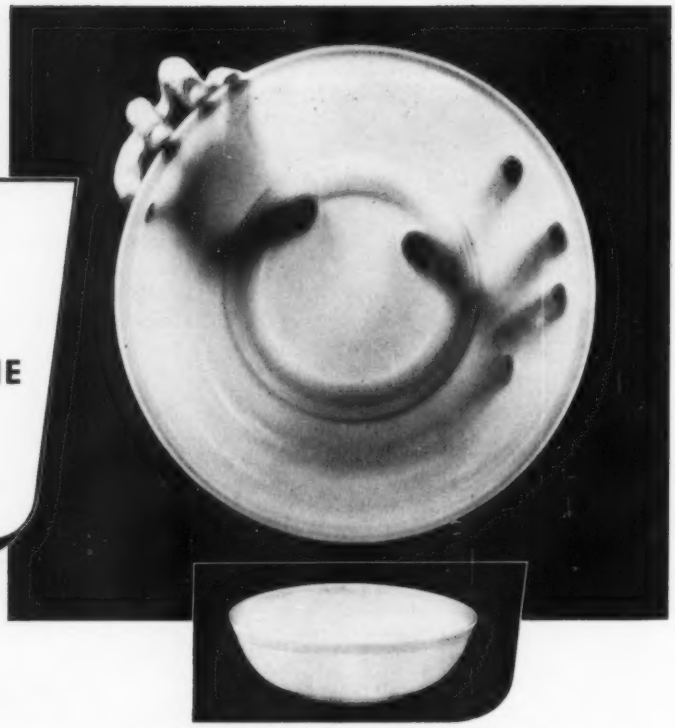
Our wide range of quality controlled phenolics embraces a combination of properties suitable to almost any application. To solve production problems... improve product performance... or add sales appeal...look to Plenco for the *right* plastic!
Phenolic thermosetting molding compounds are produced in general purpose grades and materials with special impact strength, heat resistance, or properties for deep drawing of large castings. Special purpose molding compounds in blacks, browns, mottles and other colors for particular molding requirements.
we supply the right combination
Phenolic synthetic resins are manufactured in dry, lump and finely ground particle sizes, or in solution adaptable to the application. Plenco engineers are available to help insure the success of a product through the stages from research to application.
PLENCO PHENOLICS
FOR BETTER PLASTIC PRODUCTS

For additional information on the forms, properties, and advantages of Plenco Phenolics, write to:

PLASTICS ENGINEERING COMPANY
Sheboygan, Wisconsin

LOOK!

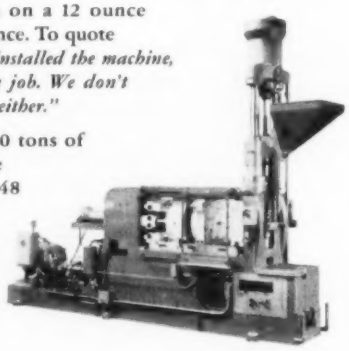
108 SQ. INS. OF POLYETHYLENE ON A 12 OZ. LESTER



. . . At Plastray Corporation in Detroit—another all-Lester shop—they're showing what can be done with Lester machines. They had done a lot of polyethylene molding on their 4 ounce and 20 ounce Lesters, when the job of running this 11-3/4" diameter, 7-1/4 ounce polyethylene bowl came their way. Without hesitation, they scheduled the job for the L-3-12 ounce Lester they had on order.

Now, that's a pretty big area of polyethylene to run on a 12 ounce machine. However, their confidence was based on experience. To quote Mr. Douglas L. Jocelyn, president of Plastray, *"We simply installed the machine, put the mold in, and started running production on the job. We don't expect any trouble with our Lesters—and we don't have any, either."*

The 12 ounce Lester is rated in polystyrene and has 350 tons of locking pressure. Write for complete specifications on the machine whose capacity is suited to your needs—4 to 48 ounces. And ask for a free copy of the "Lester Press", the Lester-Phoenix house organ filled with factual molding information.



LESTER INJECTION MOLDING MACHINES

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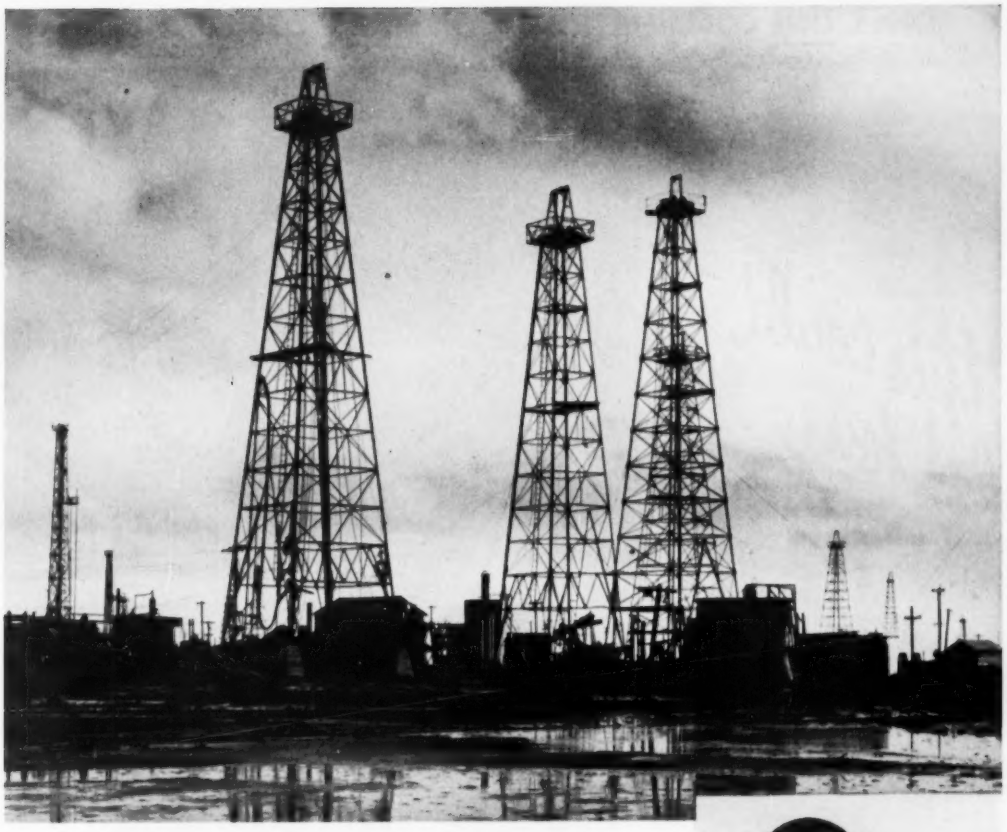

From crude to crankcase— with an assist by SYNTHANE

Without oil there'd be no automobiles or airplanes, fewer plastics, soaps, drugs, floor polishes, cosmetics, insecticides.

In one form or another, petroleum and petrochemicals are almost as important to us as the air we breathe. And in one way or another, Synthane plastic laminates are equally important to petroleum production and processing.

The reason is understandable. Synthane is a dependable material with many uses.

Because it is wear-resistant and tough, yet easy to machine, Synthane is used for components of oil well cementing equipment. Because Synthane is strong and corrosion-resistant, it is excellent for pump valves, piston rings, and compressor plates in tank-farms and refineries. Because it is a good insulator, Synthane in the form of flange insulation provides cathodic protection for pipe lines. Because it is a good moisture-resisting dielectric, light weight Synthane is used in geophysical survey equipment and oil-locating instruments. Wear-and-corrosion resistance make Synthane desirable for flow-line valve-seat inserts.

Because of all these valuable properties, plus many more, Synthane may be a material you can put to profitable use. To find out, get the complete Synthane Catalog. Write to Synthane Corporation, 4 River Road, Oaks, Pennsylvania.

Synthane Valve Ball for oil-well cementing equipment.

Piston rings for sour gas compressors, machined from Synthane.

Bushings for gas meters.

Synthane-one of industry's unseen essentials

SYNTHANE

LAMINATED PLASTICS

ONLY ONE COMBINATION IS THE RIGHT COMBINATION!

this could be Your hand....

. . . Seeking the right answer to the important question, "What equipment will do the best compounding-extruding job for me and prove the most profitable investment?"

You may find the answer in WELDING ENGINEERS dual worm machinery which provides custom-fitted compounding-extracting-extruding in ONE OPERATION. It will be an answer backed up by an outstanding record in the field and in the plants of America's leaders in plastics and chemicals. The most demanding tests and production schedules have proven its money-saving, time-saving, labor-saving performance.

It is designed to permit the correct choice of hundreds of worm combinations . . . the right combination for your specific application. Only WELDING ENGINEERS equipment permits such wide variables in heat control and mastication at every stage . . . compounding, extracting and extruding. This controlled production is responsible in large part for the success story of WELDING ENGINEERS machinery in the processing of hard-to-handle materials . . . a success story you should know about before you invest in any equipment for any combination of compounding, extracting or extruding.

Write today for your copy of our General Catalog on the Applications of Welding Engineers Compounding-Extracting-Extruding Equipment.

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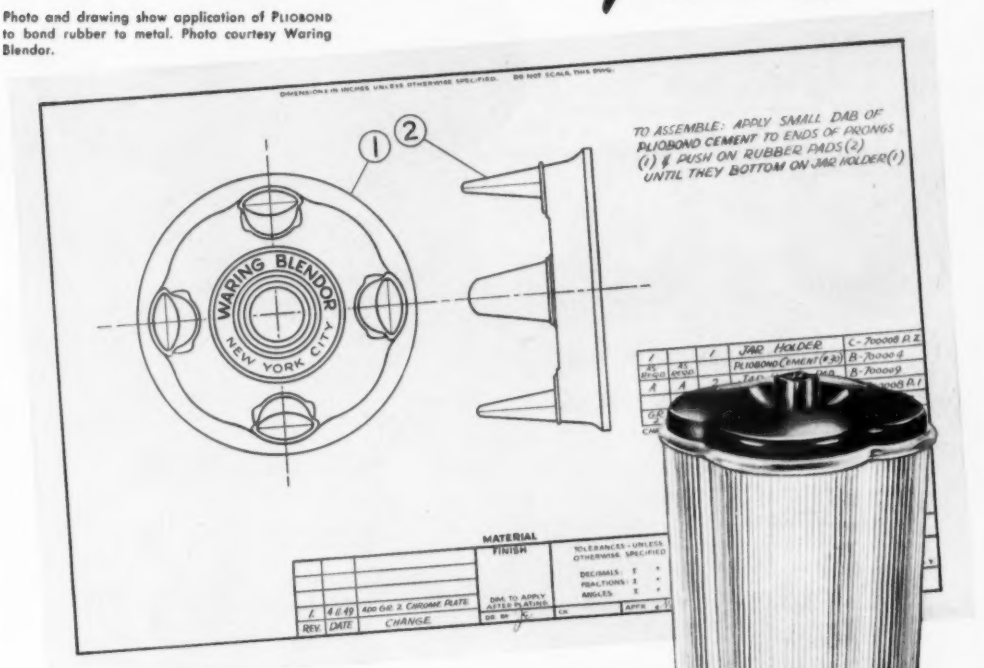
NORRISTOWN, PENNSYLVANIA • MANUFACTURERS OF IMPROVED ONE-OPERATION MACHINERY FOR THE PLASTICS, CHEMICAL AND PETROLEUM INDUSTRIES

ANOTHER ADHESIVE PROBLEM SOLVED WITH *Pliobond*

Photo and drawing show application of PLIOBOND to bond rubber to metal. Photo courtesy Waring Blendor.



"Only cement that does the job"

bonding rubber to die-cast metal

IN making this blender, four rubber fingers are bonded to die-cast metal cores on the base. The production engineer has this to say about easily applied, easily handled PLIOBOND:

"PLIOBOND is the only adhesive that successfully does the job. We have tried other kinds of cements, found that none worked very well and in most cases were harder to handle."

PLIOBOND—Goodyear's adhesive that "bonds anything to anything"—may well be your answer to production problems, too. Write today for full details to:

Goodyear, Chemical Division, Akron 16, Ohio

We think you'll like "THE GREATEST STORY EVER TOLD"
—every Sunday—ABC Radio Network
THE GOODYEAR TELEVISION PLAYHOUSE
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Chemigum, Pliobond, Pliolite, Pliovic—T.M.'s The Goodyear Tire & Rubber Company, Akron, Ohio

Use-Proved Products — CHEMIGUM • PLIOBOND • PLIOLITE • PLIOVIC • WING-CHEMICALS • The Finest Chemicals for Industry

small in size but

BIG

in opportunity for
SAVINGS

Just figure your assembly expense as compared to total production cost, and you'll see why. In some products it runs as high as 75%.

Cutting assembly costs is Parker-Kalon's specialty. You get a two-way savings. First, the Self-tapping Screw method, originated by P-K, permits you to save by eliminating needless operations. Second, with certified Self-tapping Screws of P-K guaranteed quality, you can make sure *planned* savings *pay off* on the assembly line.

A P-K Assembly Engineer will be glad to help you start making savings you've been missing. He'll call at your request. Parker-Kalon Corporation, 200 Varick St., New York 14.

PARKER-KALON®

The Original **SELF-TAPPING SCREWS**

Sold through Industrial Distributors, the Supply Specialists that serve you

GET THIS NEW GUIDE TO LOWER ASSEMBLY COST

Filled with facts you need to make sure of a two-way saving when you plan assemblies. Ask your P-K Distributor, or write Parker-Kalon for Form 475-D.

*This mark △ on every P-K Self-tapping Screw identifies it as genuine.

Now Available! A Solution to Your Dicing Problems!

The CUMBERLAND DICING MACHINE

features

THE SIMPLEST, LEAST EXPENSIVE METHOD OF DICING YET DEVISED!

USE THIS MACHINE FOR THESE OTHER APPLICATIONS, TOO!

1. Cut heavy vinylite slabs.
2. Cut continuously extruded scrap!
3. Cut side shear from calendering machines.
4. Produce pellets from continuous strands.

For details, request Bulletin 401.

This new Cumberland dicing (or cubing) machine efficiently dices plastic sheet stock into a wide variety of cube sizes. Input speed ranges from 10 feet to 125 feet per minute.

A proven machine, the Cumberland dicer is a modified form of the well-known rotary chopping machine regularly used for many applications throughout the plastics industry. The new dicer has satisfactorily diced *millions* of pounds of plastics!

If you are interested in dicing plastic materials easily and inexpensively, you'll want to investigate the Cumberland dicing machine right away!

WRITE FOR COMPLETE TECHNICAL DETAILS!

CUMBERLAND MANUFACTURES A COMPLETE LINE OF PLASTICS REDUCING MACHINES

PREBREAKER

Cuts up radio, television cabinets and other large parts. Available with 20" by 32" throat opening (Model 32) and 10" x 24" throat opening (Model 24). Write for details.

GRANULATING MACHINES (All Models)

Seven different models, direct coupled and V-belt driven, are available to meet your requirements. For complete details, request Bulletin 251.

MODEL 18 GRANULATOR

Large capacity double-hung construction for heavy duty applications. Like all Cumberland machines, it is easy to adjust, dismantle, and clean.

CUMBERLAND Engineering Company Inc.

BUILDERS OF BETTER MACHINES FOR THE PLASTICS INDUSTRY

DEPT. 1 · BOX 216 · PROVIDENCE · RHODE ISLAND

California Representative:
WEST COAST PLASTICS DISTRIBUTORS, INC.
4113 West Jefferson Blvd., Los Angeles 16, Cal.

Why the VINYL FLOORING INDUSTRY turns to "Dutch Boy" Normasal Vinyl Stabilizer to improve its product

"Dutch Boy" Stabilizers

PRODUCT	USE
TRIBASE (Tribasic Lead Sulphate)	Electrical and other compounds requiring high heat-stability
TRIBASE E (Basic Lead Silicate Sulphate Complex)	Low volume cost insulation
DS-207 (Dibasic Lead Stearate)	Stabilizer-lubricant for sheeting, film, extrusion and molded compounds
PLUMB-O-SIL A (Co-precipitate of Lead Orthosilicate and Silica Gel)	Translucent and colored sheeting and upholstery stocks
PLUMB-O-SIL B (Co-precipitate of Lead Orthosilicate and Silica Gel)	Translucent and colored film, sheeting, belting
PLUMB-O-SIL C (Co-precipitate of Lead Orthosilicate and Silica Gel)	Highly translucent film and sheeting
DYTHAL (Di-basic Lead Phthalate)	General purpose stabilizer for heat and light. Good electrical properties
DYPHOS (Di-basic Lead Phosphite)	Outstanding for heat and light in all opaque stocks, including plastisols and organosols
	As stabilizer or co-stabilizer in vinyl flooring and other compounds requiring good light-stability
BARINAC (Barium Ricinoleate)	Stabilizer-lubricant for clears

Asbestos filler is important in the making of high grade vinyl flooring. To use it satisfactorily, the industry has turned to "Dutch Boy" Normasal.

Normasal, flooring makers have found, is the *only* stabilizer that prevents the color changes in vinyl formulations that asbestos impurities sometimes produce.

More often than not, Normasal is "teamed up" with Tribase, a "Dutch Boy" stabilizer that provides the high heat stability needed in processing vinyls.

For more information about Normasal, Tribase, or any of the other "Dutch Boy" Stabilizers, write us. We will be glad to give you additional data and technical information.

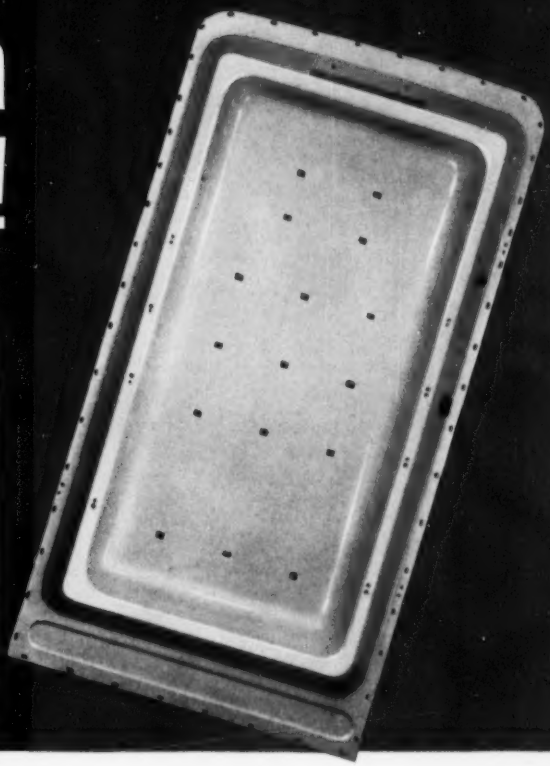
NATIONAL LEAD COMPANY
111 Broadway • New York 6, N. Y.

Dutch Boy

*Reg. U. S. Pat. Off. **CHEMICALS** *

In Canada:
CANADIAN TITANIUM PIGMENTS LIMITED
630 Dorchester Street, West • Montreal

Largest area ever molded!



General American's 1800 square inch inner door panel for the new 1953 WESTINGHOUSE 12FT. REFRIGERATOR

SIZE: Approximately 1800 sq. inches (59¾" h. x 32" w.)
MATERIAL: High-impact polystyrene
MOLDING: performed on one of General American's battery of 300-oz. injection presses

NEW SALES FEATURES:

Unexcelled luster and appearance
Very easy to clean
Does not absorb odors
Color all the way through
Chip and crack resistant
Permits deeper shelves
Increases cubic content
Strong and dimensionally stable

Member, Committee on Large Plastics Molding

Not very long ago, engineers would have said, "You can't do it! Too big! Too difficult!" But as in so many cases with plastics, none of the objections held up. Good creative engineering, thorough understanding of materials and large production equipment enabled General American and Westinghouse engineers to do the job.

The result: A panel so sturdy that it is a structural member of the door. Rounded contours which permit flexible shelf arrangement. Many new sales and production features—*another good example of precision molding by General American to back up industry's production lines.*

General American's facilities and experience in molding injection, compression and reinforced plastics may hold the answer to your production needs, too. Why not find out?

plastics division
GENERAL AMERICAN TRANSPORTATION CORPORATION
135 South La Salle Street, Chicago 90, Illinois
10 East 49th Street, New York 17, New York

The Super High-Speed machine you have been waiting for

THE DOWDING

AUTOMATIC *FAST-CYCLING*

INJECTION MOULDING MACHINE

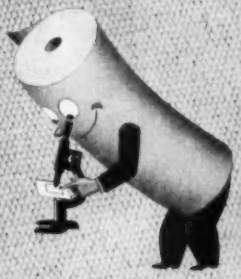
- Fully automatic and foolproof
- Fast plasticizing at unusually low injection presssure
- 3 zone cylinder heating
- Vickers hydraulic equipment
- Automatic lubrication
- Made in England
- Built to American screw thread standards
- Early delivery

SPECIFICATIONS

Cycles per hour (maximum)	1200
Material plasticized per hour (dependent upon shot size and material)	22 lb.
Area of injection plunger	2.074 sq. in.
Pressure on material at end of plunger	9100 lb./sq. in.
Total pressure on injection plunger	18850 lb.
Mould opens (adjustable)	9 in.
Maximum die space	7 in.
Minimum die space	3 in.
Maximum recommended casting area in mould	15 sq. in.
Size of die plates	10 x 16 in.

DOWDING & DOLL LTD
CABLES
GREYCOAT STREET, LONDON, S.W.1
ACCURATOOL, LONDON

UNIFORMITY
Makes The Big Difference
In LAMINATION FABRICS
MT. VERNON EXTRA
Gives You Greater Fabric Uniformity



Checking evenness of roving with Belger Tester.

One of a series of comprehensive laboratory controls throughout production to assure uniformity in all Mt. Vernon-Woodberry products.

Mt. Vernon-Woodberry Mills

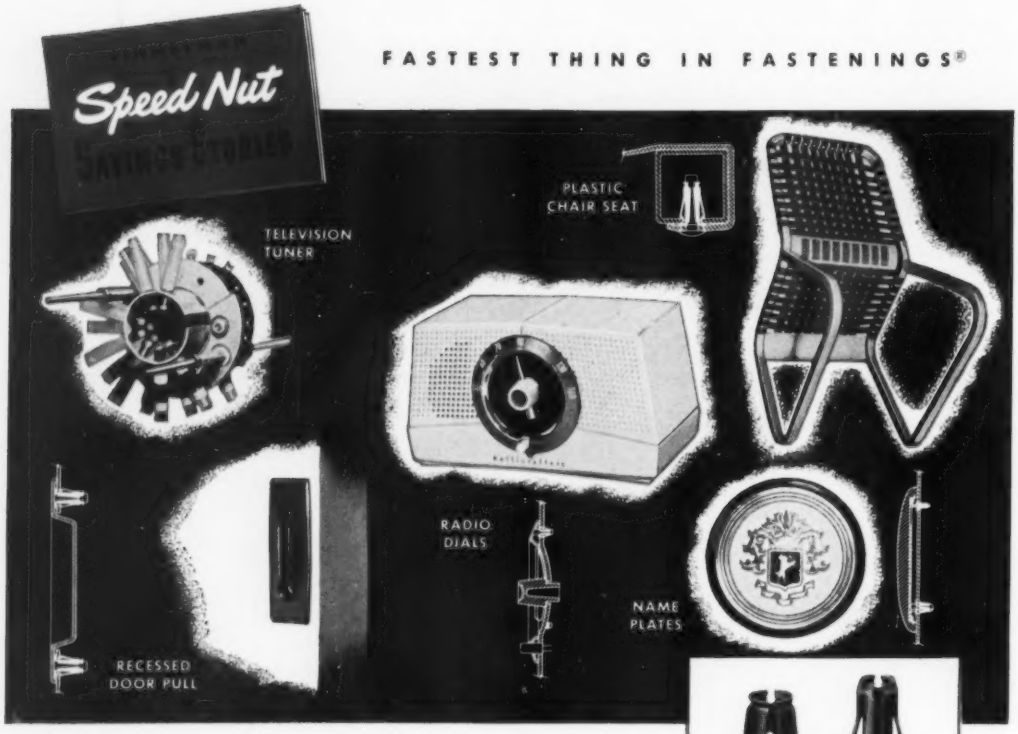
Branch Offices: Chicago • Atlanta
Baltimore • Boston • Los Angeles

TURNER HALSEY COMPANY
Selling Agents
40 WORTH ST NEW YORK

FABRICS ENGINEERED TO FIT YOUR NEEDS

Need adaptation of an existing fabric to your special purposes? Or creation of an entirely NEW fabric — cotton, synthetic or blend — to meet your specifications? Mt. Vernon-Woodberry's staff of textile engineers is available on request to help you with your problems in development or application of industrial fabrics.

FASTEST THING IN FASTENINGS®



Tubular **SPEED CLIPS**® in Plastic applications increase production . . . save 50% Assembly Costs!

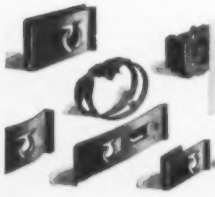
Makers of plastic products find Tinnerman Tubular Type SPEED CLIPS save time, money, and materials, especially in difficult, "blind" assembly attachments! Production savings of more than 50%, plus substantial increases in output, are being made by the use of Tubular SPEED CLIPS to solve fastening problems in a variety of plastic applications. Hundreds of types and sizes are available. They snap into place by hand, are self-retaining in molded or punched holes; can be easily applied over integrally molded studs; eliminate costly threaded inserts! Material costs, and materials handling are reduced!

See the Tinnerman representative in your area soon for data on better fastening methods for your products!

Tubular Type Speed Clips

Tinnerman Tubular SPEED CLIPS are heat treated spring steel fasteners, available in a wide range of sizes, in rust-resistant finishes. Hundreds of applications have been developed, and specification data is available on request. Send today for Tinnerman Bulletin #330 on Tubular SPEED CLIP specifications.

Write direct for SPEED NUT "Savings Stories", and your copy of Tubular Type SPEED CLIP data to: TINNERMAN PRODUCTS, INC., Box 6688, Dept. 12, Cleveland 1, Ohio. *In Canada:* Dominion Fasteners Ltd., Hamilton, Ont. *In Great Britain:* Simmonds Aerocessories, Limited, Treforest, Wales. *In France:* Aerocessoires, Simmonds, S. A. — 7 rue Henri Barbusse, Levallois (Seine).



TINNERMAN Speed Nuts®

MORE THAN 8000 SHAPES AND SIZES

open door to better service — with C-11 plastics

The door of every new Servel "Automatic Ice-Maker" refrigerator carries three shelves on its inner side. Shining and clean-lined, they accent the interior's up-to-the-minute styling. Molded from BAKELITE C-11 Plastics for toughness, they'll hold bottles, cans and jars of foods used most.

The shelves are molded to sharp detail in one minute between 580 and 660 deg. F. Each weighs only eight ounces. Spraying the under side with gold paint gives them their rich metallic luster. For attachment to the door, they have studs molded with holes that become self-threading when screws are inserted.

BAKELITE C-11 Plastics are acrylonitrile-styrene copolymers that have several features distinct from both acrylic and styrene plastics. One such feature is strength—their tensile and flexural strengths are 45% higher than those of standard polystyrenes. Another is durability—they withstand contact with tea, coffee, citrus peels, soaps, detergents, oils, cosmetics. Their dimensional stability is excellent.

With this combination of properties, BAKELITE C-11 Plastics are extending the usefulness of plastics in such fields as housewares, packaging, product design. For more information about them, write Dept. PI-13.

Door shelves for the Servel "Automatic Ice-Maker" Refrigerator molded by Kusan, Inc., Nashville, Tenn.

BAKELITE
TRADE-MARK
C-11 PLASTICS

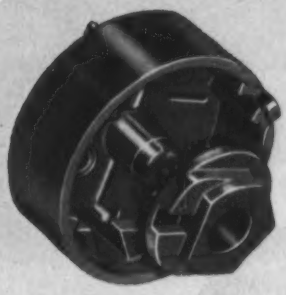
TRADE MARK

BAKELITE COMPANY
A Division of
Union Carbide and Carbon Corporation
UCC
30 East 42nd Street, New York 17, N. Y.
In Canada:
Bakelite Company (Canada) Ltd., Belleville, Ont.

If It's Made of Plastic...

We Can Mold It!

The complete, modern facilities of Mallory Plastics include injection, transfer and compression molding equipment, in a wide range to meet your production requirements. Our engineers will assist you in product design . . . help select the right material for your job . . . and engineer and build precision molds. Here are examples of current production.



Switch Case and Rotor

Transfer molded of general purpose phenolic. Tolerances of ±.002" were maintained in over 60 dimensions in the molds. Core blades were extra thin and required special heat treating to withstand molding pressures.

Capacitor Case

Injection molded of acrylic for moisture and heat resistance. Mold was designed with pinpoint gating which permitted the use of an ingenious stripper plate. This eliminated the necessity for de-gating or handling after molding.

Hair Dryer Hood

Compression molded of general purpose phenolic. Plastic replaced metal in this application which required heat resistant material designed for lightness, yet strong enough to withstand rough treatment.

If your product or one of its components can be made of plastic, we can handle the entire job to your most exacting requirements . . . with delivery to meet your production schedules. For full information, write or call us today.

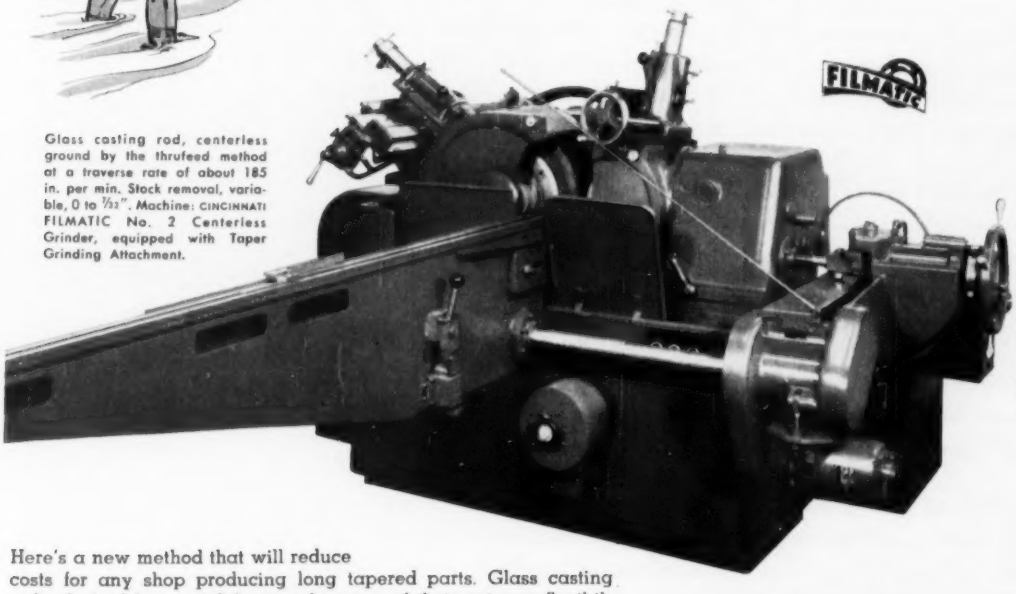
P. R. MALLORY PLASTICS, INC.

3670 MILWAUKEE AVE. • CHICAGO 41, ILLINOIS

A subsidiary of P.R. MALLORY & CO. Inc. MALLORY

Cincinnati Filmatic Centerless

Automatically grinds taper on glass casting rods



Glass casting rod, centerless ground by the thrufeed method at a traverse rate of about 185 in. per min. Stock removal, variable, 0 to 7/32". Machine: CINCINNATI FILMATIC No. 2 Centerless Grinder, equipped with Taper Grinding Attachment.

Here's a new method that will reduce costs for any shop producing long tapered parts. Glass casting rods, desired by most fishermen because of their extreme flexibility and high strength, are now *centerless ground* by the thrufeed method. To perform this operation, a CINCINNATI FILMATIC No. 2 Centerless Grinder is equipped with a taper grinding attachment. The work is mechanically pushed between the wheels at a rate of about 185 in. per min. As feeding progresses, the regulating wheel unit, through a cam and hydraulic cylinder arrangement, increases the distance between the wheels. Exceptionally accurate tapers are produced within ± .001" in 3" increments of length. By changing the cams and/or the change gear ratio, almost any desired taper can be thrufeed centerless ground. ¶ This ingenious centerless taper attachment, coupled with the advantages offered by CINCINNATI FILMATIC Centerless Grinders, give you a combination that can't be beat for low-cost accurate performance. One feature alone, FILMATIC grinding wheel spindle bearings, is sufficient reason to choose Cincinnati. And as always, our Application Engineers will be glad to help you with your precision grinding problems.

Deliveries on standard CINCINNATI FILMATIC No. 2 Centerless Grinders (above) are better than you might imagine. They are versatile precision grinding machines for small quantities or large lots. You may obtain complete data by writing for catalog No. G-611.

CINCINNATI GRINDERS INCORPORATED • CINCINNATI 9, OHIO

CINCINNATI CINCINNATI

CENTERTYPE GRINDING MACHINES • CENTERLESS GRINDING MACHINES
CENTERLESS LAPPING MACHINES • MICRO-CENTRIC GRINDING MACHINES

NOW
you can have STRUX in any size!

There are no longer *any* limitations. Whether you need it man-size, giant-size or larger . . . if you can handle it, we can make it.

Primarily, our newest machine extrudes much larger sizes. But, more important, we have developed a new technique employing thixotropic resins enabling us to combine these larger sizes with fewer glue lines into finished pieces of any size and almost any shape.

YOU CAN DO IT YOURSELF If your facilities permit and you would prefer to handle the assembly in your own plant, we will furnish the STRUX, the resins and give you the advantage of our know-how.

STRUX IS LOWER IN PRICE Accelerated production over four times that of 1952 and larger standard as well as special sizes have made it possible for us to reduce substantially the price of this cellular cellulose acetate.

THERE IS NO SUBSTITUTE FOR STRUX This material is in a class by itself . . . different than any other expanded plastic you have ever known. These unique characteristics tell the story:

- Lighter than balsa wood
- Great structural strength (as a core in sandwich construction)
- Insulates against heat and cold
- Excellent electrical qualities
- Unusually buoyant (in water, oil and other liquids)
- Resists high temperatures
- Good machineability (hold high tolerance)

SEND FOR A FREE SAMPLE
You must see STRUX to fully appreciate its potentials in your industry. Write today! We'll send you a sample, an illustrated folder with prices and a price list of STRUX sandwich structures.

STRUX CCA

STRUX CORPORATION

13 SOUTH 12th STREET • LINDENHURST, L. I., N. Y.
LINDENHURST 5-1700

Representatives in LOS ANGELES • KANSAS CITY • TOLEDO • MIAMI • ATLANTA • TORONTO

*T.M. Reg.

THE VISKING CORPORATION

"The world's largest producer of polyethylene films"

Uses NRM EXTRUDERS for More than 90% of its Production

THE remarkable growth of The Visking Corporation, since its establishment in 1925, proves again that a business succeeds only as it consistently satisfies its customers' demands and requirements.

As The Visking Corporation put it in its 25th Anniversary brochure . . . "this company recognizes a responsibility that extends far beyond the actual sale. It is the service of technicians, laboratories, research and trained sales personnel who are ever ready to help solve any problem, anytime . . . anywhere."

The same basic philosophy that has helped make The Visking Corporation "the world's largest producer of polyethylene films" has helped make NRM the world's largest producer of plastics extrusion equipment.

The leaders in the field of plastics extrusion turn naturally to NRM, the leader in the field of plastics extruders. NRM built the first extruder especially designed for thermoplastics . . . designed the first electrically heated extruder . . . the "torpedo type" feed screw . . . developed balanced heat control . . . and the quick opening die gate.

Weigh this impressive record of "firsts" in extruder design, with the proved performance of NRM extruders the world over — and we're sure your next extruder will be "another NRM."

Preston Division, Terre Haute, Indiana, one of the four divisions of The Visking Corporation, occupies 63,000 square feet of floor space all devoted to the production of plastic film.

2115

NATIONAL RUBBER MACHINERY COMPANY

NRM Our 25th ANNIVERSARY 1928 1953

Creative Engineering

General Offices & Engineering Laboratories: Akron 8, Ohio
East: 384 Getty Ave., Clifton, N. J.
West: S. M. Kipp, Box 441, Pasadena 18, Cal.
Export: Omni Products Corporation, 460 Fourth Ave., New York 16, N. Y.

HOW MUCH WILL CORROSION

HOW MUCH WILL

CORROSION

COST YOU THIS YEAR?

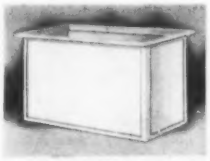
CHEMICALS CAN CORRODE METALS IN 12 MONTHS OR LESS.

UNPLASTICIZED P.V.C. JUST DOESN'T CORRODE.

Not a cent...IF YOU SWITCH TO

UNPLASTICIZED P.V.C. MADE FROM FIRESTONE EXON 402-A

Unplasticized P.V.C. is a new material of construction that is highly resistant to most corrosive elements. In many industrial applications, it has proven to be superior–less expensive–than customary metals. Check carefully the advantages of Unplasticized P.V.C. Then, for detailed information on how this new material of construction can help you in *your* business, consult Firestone Chemical Sales Division.



Fume Ducts, Tank Liners, Similar Applications–Unplasticized P.V.C. made from EXON 402-A is ideal for fume ducts and tank liners because it is highly resistant to moisture, acids, oxygen, sunlight, ageing and other corrosive elements.

Industrial Pipe–Naturally, piping extruded from Unplasticized P.V.C. is resistant to all types of corrosion. What's more, it is extremely light weight in comparison to metal...therefore easier and less expensive to handle.

Versatility–Unplasticized P.V.C. made from EXON 402-A can be welded, sawed, sheared, stamped, milled, planed, drilled, embossed, rolled, cemented. It is easily worked on conventional metal and wood working equipment.

How does this new material of construction fit into *your* picture? Have your engineers consult the Firestone Chemical Sales Division on proper applications of Unplasticized P.V.C. made from EXON 402-A...or write:

Firestone ..... EXON ..... *Chemical Sales Division*

FIRESTONE PLASTICS COMPANY
POTTSTOWN, PENNSYLVANIA
A Division of Firestone Tire & Rubber Co.

IMPORTANT: Firestone supplies EXON 402-A only. This resin is used by many of America's leading fabricators of Unplasticized P.V.C. end-products

COST YOUR CUSTOMERS THIS YEAR?

Not a cent... IF YOU SELL THEM

UNPLASTICIZED P.V.C. MADE FROM FIRESTONE EXON 402-A

America's leading manufacturers are becoming more and more *corrosion conscious!* And no wonder. Every year, corrosion costs industry millions of dollars.

That's why Firestone has scheduled an entire series of full-page advertisements to appear in *Business Week* and *U. S. News and World Report.* (The first advertisement in this series is illustrated on the opposite page.)

These advertisements were designed with one thought in mind: to suggest Unplasticized P.V.C. to businessmen as a possible solution to their corrosion problems. In doing this, the series will stimulate an increased demand for this new material of construction. Have *you* considered ways in which you can adapt this new material of construction to products you now make or could make with your present production facilities?

Unplasticized P.V.C. that is made from Firestone EXON 402-A is highly-resistant to moisture, acids, oxygen, sunlight, aging and other corrosive elements. It is extremely lightweight in comparison to metal ...and therefore easier and less expensive to work with.

What's more, Unplasticized P.V.C. made from Firestone EXON 402-A can be welded, sawed, sheared, stamped, milled, planed, drilled, embossed, rolled, punched, cemented. It is easily worked on conventional metal- and wood-working equipment.

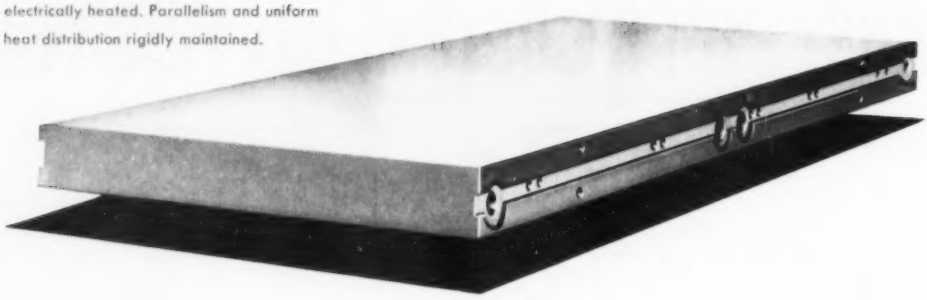
☆ ☆ ☆

Firestone has the experience and technical background to help you meet the increased demand for Unplasticized P.V.C. For detailed information on applications...and for advice and consultation on new uses you may discover ...call or write:

Chemical Sales Division

DEPARTMENT 11B,
FIRESTONE PLASTICS COMPANY
POTTSTOWN, PA.
A Division of Firestone Tire & Rubber Co.

Precision platens either steam or electrically heated. Parallelism and uniform heat distribution rigidly maintained.



R.D.Wood Heating Platens

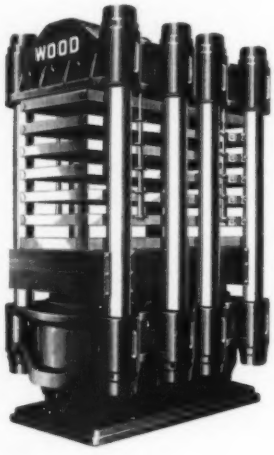
Long experienced in the design and manufacture of press heating platens, R. D. Wood Company supplies units in every practical size for every practical application.

These rolled steel heating platens meet the most exacting requirements in the processing of all types of rubber and plastics, the manufacture of plywood, veneers, wallboard, hardboard, pressed woods, and various types of composition flooring.

Write for descriptive literature.

Multiple-platen, 3675-ton hydraulic press for hardboard production.

Multiple-platen, 1327-ton hydraulic press for manufacture of molded brake lining and similar products.



150th anniversary

WOOD

R. D. WOOD COMPANY

PUBLIC LEDGER BUILDING, PHILADELPHIA 5, PA.

HYDRAULIC PRESSES AND VALVES FOR EVERY PURPOSE • ACCUMULATORS • ALLEVIATORS • INTENSIFIERS

at your finger tips... **FOSTARENE**

new major source

a

for **VIRGIN POLYSTYRENE**

MUEHLSTEIN

EXCLUSIVE DISTRIBUTORS

● Look to Muehlstein—exclusive distributors of Fostarene—as a new permanent source of virgin clear and colored Polystyrene. Muehlstein's nationwide sales organization and their long experience in this and allied fields assure you of constantly reliable service, stability and efficiency. Write or call for further information.

H. MUEHLSTEIN & CO.

60 EAST 42nd STREET, NEW YORK 17, N. Y.

BRANCH OFFICES: Akron • Chicago • Boston • Los Angeles • Memphis

plastics take to the backyard

The backyard swimming pool is now easily available to everybody's kids . . . thanks to plastics.

Bright, gay, durable colors help sell plastic pools—and thousands of other plastic objects. And that's where TITANOX titanium dioxide pigments come into the plastics picture.

For nothing can compare with titanium dioxide pigments for brightening, whitening, opacifying or beautifying plastic compounds. If you have a plastic pigmentation problem, consult our Technical Service Department.
Titanium Pigment Corporation, 111 Broadway, New York 6, N. Y.; Boston 6; Chicago 3; Cleveland 15; Los Angeles 22; Philadelphia 3; Pittsburgh 12; Portland 9, Ore.; San Francisco 7.
In Canada: Canadian Titanium Pigments Limited, Montreal 2; Toronto 1.

®TITANOX
the brightest name in pigments

TITANIUM PIGMENT CORPORATION
Subsidiary of NATIONAL LEAD COMPANY

DE MATTIA INJECTION MOLDING MACHINES

DE MATTIA
MACHINE and TOOL CO

—FAMOUS FOR SUPERIOR PERFORMANCE!

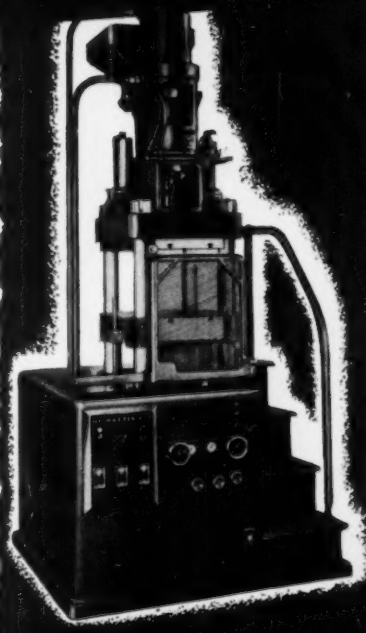
INSTALL DE MATTIA for the kind of molding performance that places the emphasis on fast production and minimizes your rejects. In addition to advance design advantages, every De Mattia model is built rugged to assure smooth, dependable operation with a minimum of maintenance "down time". Ask for the facts on De Mattia equipment for the modern molding plant, today!

DE MATTIA TIME-AND-MONEY-SAVING FEATURES!

- **Exceptionally Heavy Tension Members**
- **High Mold Clamping Pressure**
- **Uniform Hydraulic Pressure On Entire Die Face**
- **Large Plasticizing Capacity**
- **Positive Heat Control**
- **Fast Color Changing with Minimum Loss of Material**

DE MATTIA
MACHINE and TOOL CO.
CLIFTON • NEW JERSEY

New York Sales Office: 30 Church St.
Cable Address: Bramach, New York
Midwestern Representative: E. Maywald
189 West Madison St., Chicago 2, Illinois

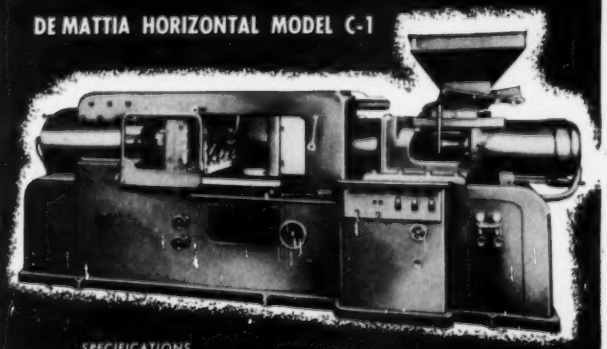


DE MATTIA VERTICAL MODEL G-1

SPECIFICATIONS

Ounces Molded per Shot — 4 (Styrene); Pounds of Plasticized Material per Hr. — 50; Capacity of Feed Hopper (Lbs.) — 50; Diameter of Injection Plunger — 1 7/8"; Diameter of Hydraulic Injection Cylinder 8 1/2"; Pressure on Material — 20,500 lbs. per sq. in.; Size of Die Plates — 14" x 23"; Mold Opens — Stroke — 15"; Max. Daylight — 19"; Min. Die Space — 4"; Motor — 20 HP @ 1,200 RPM; Pump Capacity — 34 GPM @ 1,000 PSI; Mold Closing Pressure (Tons) — 150; Floor Space Required — 47" x 59" — Height Over All — 108"; Approximate Wt. of Machine (Tons) — 4 1/4; Injection Piston Stroke — 7 1/4"; Closing Cylinder Bore — 8 1/16"; Complete Injection Time (Max.) — 1.88 Sec.; Heating Cylinder — 4,350 Watts.

DE MATTIA HORIZONTAL MODEL C-1



SPECIFICATIONS

Material per Injection — 12 ozs.; Plasticized Material per hour — 130 lbs.; Feed hopper Capacity — 60 lbs.; Injection Piston Diameter — 2 1/4"; Injection Piston Stroke — 11 1/2"; Hydraulic Injection Cylinder Bore — 13"; Pressure on Material — 22,500 PSI; Mold Closing Pressure — 400 Tons; Max. Mold Size — 18" x 25"; Max. Daylight — 30"; Min. Die Space — 6"; Max. Stroke — 24"; Oil Pump Capacity — 60 GPM @ 1000 PSI, Max.; Motor — 30 HP; Injection Stroke Time, for Filling Mold — 3.0 Secs.; Speed of Injection Piston, Forward — 120" per Min.; Heating Cylinder — 13,000 Watts; Height of Machine, Overall — 72"; Floor Space Required — 172" x 42"; Approx. Weight — 10 Tons.

What's Screwy? by Phillips

"Oh, he never bothers to turn it on. He's just fascinated by the beauty of those Phillips Cross-Recessed-Head Screws."

PERFECTLY MATED! Only Phillips Drivers are perfectly mated to Phillips Screws. Look for the name Phillips on the shank.

BEAUTY is only one of many reasons why Phillips Screws help you build a better product. These screws set up tighter, resist vibration. They are distinctively designed to give maximum strength of head, maximum driver strength. What's more, they cut driving time up to 50%, eliminate driver skids and split screw heads. Whether you use Phillips Wood, Machine, Tapping Screws or "Sems", you save time, work, money.

PHILLIPS *Cross-Recessed-Head* SCREWS

X marks the spot... the mark of extra quality

AMERICAN SCREW COMPANY • ATLANTIC SCREW WORKS, INC. • THE BLAKE & JOHNSON CO.
CENTRAL SCREW COMPANY • CONTINENTAL SCREW COMPANY • THE EAGLE LOCK COMPANY
ELCO TOOL AND SCREW CORPORATION • GREAT LAKES SCREW CORPORATION • THE H. M. HARPER CO.
THE LAMSON & SESSIONS COMPANY • NATIONAL LOCK COMPANY
THE NATIONAL SCREW & MANUFACTURING CO. • PARKER-KALON CORPORATION
PHEOLL MANUFACTURING CO. • ROCKFORD SCREW PRODUCTS CO. • SCOVILL MANUFACTURING CO.
SHAKEPROOF DIV. OF ILLINOIS TOOL WORKS • THE SOUTHINGTON HOWE MFG. COMPANY
STERLING BOLT COMPANY • STRONGHOLD SCREW PRODUCTS, INC. • WALES-BEECH CORP.

TODAY'S...AND THE FUTURE'S...FINEST FASTENER

Housed in a new, flame-resistant Hercocel plastic, this Portable Mixer is General Electric's latest example of good styling and truly practical performance in kitchen aids. Flame-resistant Hercocel means not only added safety, but high impact strength . . . a lustrous, chip-proof finish . . . and a degree of operating quietness that's unattainable with other housing materials. Many large plastic units, heretofore impractical, are now made possible with this new, flame-resistant, high-impact Hercocel. For further information on Hercocel and the Hercules design assistance, technical counsel, and laboratory assistance that go with it, write or call:

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Cellulose Products Department, 916 Market Street, Wilmington 99, Del.

Peas in a pod appear to be identical in colour and size—but close inspection and measurement would reveal considerable differences. That they are apparently uniform is a mere chance.

P. 4½" PLASTIC EXTRUDER

Driven by a 30/10 H.P. variable speed commutator motor, giving 3 to 1 speed range so that by means of the vee rope drive any desired range of speeds between 8 and 75 R.P.M. may be obtained.

All electric heating with separately controlled barrel and die head heater zones has been a unique feature of Shaw machines for over 12 years. The output is approximately 200/250 lb. per hour.

Leaflet No. P. 321 gives full details.

The uniformity of the plastic extrusions produced with Shaw machinery is no chance—it is by design. Shaw Plastic Extruders ensure complete uniformity in the continuous production of tubing, miscellaneous sections, insulating and sheathing of cables, film, colour mixing and the delivery of milled and molten material for sheeting and casting purposes.

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Industry's headquarters for the best in plastic and rubber machinery

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No matter how you measure it– plastic gage stays accurate with calender rolls on TIMKEN® bearings

WHEN you mount calender rolls on Timken® tapered roller bearings, the gage of plastic film and rubber sheeting *stays* uniform, because Timken bearings hold rolls in accurate alignment. You get uniform gage for the length of the sheet, sheet after sheet. And you get more yards per pound of material, because Timken bearings hold gage to minimum tolerances.

Roll necks do not require remachining since the tight fit between the neck and the bearing inner race eliminates roll neck wear. As a result, down-time is minimized.

The true rolling motion and smooth surface finish of rollers and races of Timken bearings practically eliminate friction and wear within the bearing. You maintain calender roll precision for longer periods of service.

Timken bearings are tapered in construction which permits them to take radial and thrust loads in any combination. Line contact between rollers and races gives them extra load-carrying capacity.

Make sure you get all the advantages of Timken bearings in your calenders, mills, refiners and mixers. For full information, write The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

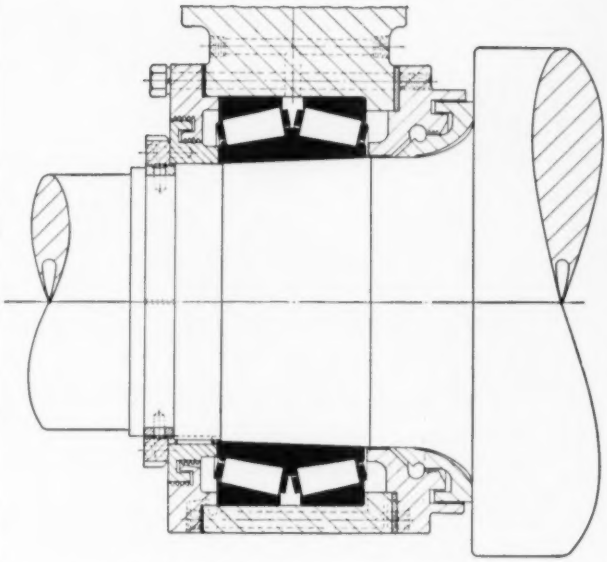

Diagram shows how calender rolls are mounted on Timken tapered roller bearings to maintain uniform gage of plastic film and rubber sheeting.

TIMKEN

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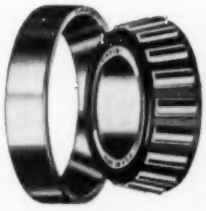
TAPERED ROLLER BEARINGS



NOT JUST A BALL ○ NOT JUST A ROLLER ▭ THE TIMKEN TAPERED ROLLER ▭ BEARING TAKES RADIAL ◫ AND THRUST →◫← LOADS OR ANY COMBINATION →◫←

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Glidden research has achieved greater whiteness and a highly accelerated dispersion rate in new Glidden ZOPAQUE-R. These new developments combine to produce pigments with exceptional hiding power, outstanding gloss and color retention and low reactivity.

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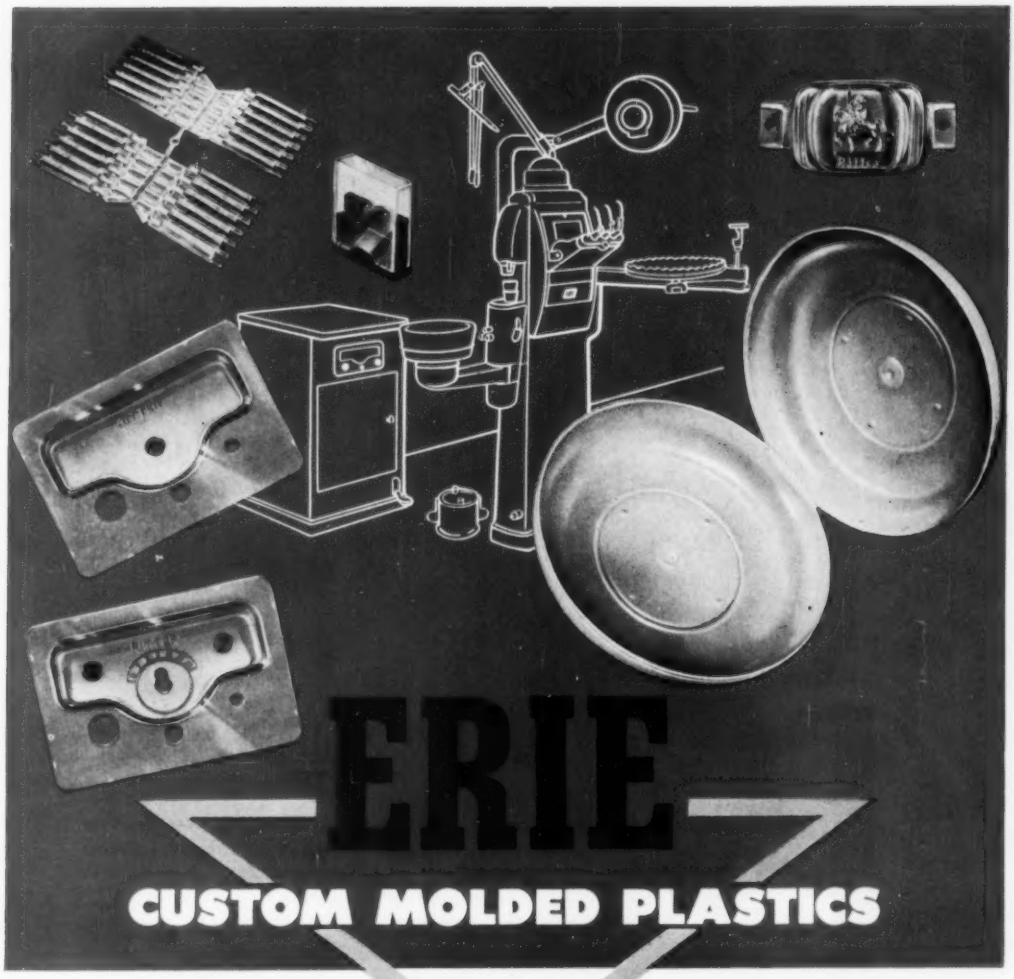

for the Dentist and the Doctor

The professions, too, are using Erie Custom Molded Plastics. The dentist's lamp by Ritter Company, Inc. is the scientific answer to the operator's illumination problems. Two shallow bowls, each 13⁹⁄₁₆" in diameter, are molded of translucent polystyrene to mate accurately and illuminate the entire working area, while a strong light is focused on the area of the operation. The luscite control panels, the compact drill case, and the outstanding three dimensional name plate shown above are made for the same company.

The transparent "Twin-Pak" Hypodermic Needle Holder was an ingenious idea that baffled economic production until the problem was presented to Erie. Twenty-four "Twin-Paks" are molded at one time to make four separate units of six tubes each, which are easily broken apart at the doctor's convenience. It is manufactured for Becton, Dickinson and Company.

Write for your copy of Bulletin, "Who We Are, What We Do"

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The Little Big Shot in Plastics!

Small but powerful . . . the **LEWIS "4"** is the lowest cost machine available today for production molding of lightweight large-area parts. Only the **LEWIS "4"** can mass produce 2 to 3-ounce parts in molds originally designed for 8-ounce machines. It's compact . . . simple to operate . . . economical to buy and use.

The **LEWIS "4"** features semi-automatic operation, multiple shot injection and full-mold high-pressure injection at low plunger pressures. Exclusive fast-opening crank-operated die-lock mechanism permits operator to release dies and clear jammed nozzles in 20 seconds or less without leaving the operating panel.

The **LEWIS "4"** handles almost any molding material and accommodates molds up to 12x23" mounted vertically and 13⅜x20" horizontally . . . yet it requires only 16 sq. ft. of floor space and operates so quietly you can use it anywhere.

Dollar for dollar, the LEWIS "4" gives you more!

Write today for illustrated Catalog No. 101 for additional details

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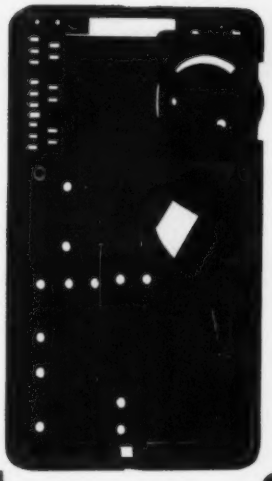
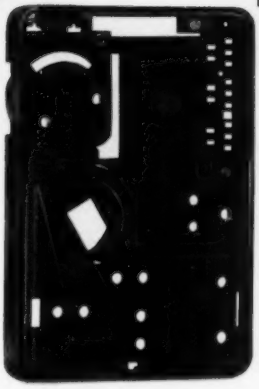


Two latest hearing aid cases molded for Beltone Co., Chicago (Shown actual size)



Casting your plastics problems in their EXACT mold

As electronic hearing aids grow smaller in size, the technical problems of their manufacture grow larger in scope. Beltone, one of several hearing aid manufacturers who are repeatedly using Mills engineering and molding skills, recognized this when they called on us to do their latest models. All of the electrical and mechanical components of a full sized hearing aid had to be mounted in a case a fraction of its conventional size. The resultant complexity of the case raised problems unprecedented in mold design, construction and molding techniques.

Many fine, complex cores had to be built to the same critical tolerances the entire unit demanded. Delicate side core mechanisms had to be built at either end of the case. Four tiny threaded metallic inserts had to be molded into the case. Due to the numerous small, delicate cores, because of many metal-to-metal shut offs required, flash control and weld lines were treated as major molding problems.

Our engineering and molding skills, sharpened by this and similarly challenging jobs, are at your service without obligation. We'd welcome a chance to help you solve your plastics problems wisely, economically and correctly today.

Write on your letterhead for the new Injection Molded and Extruded Plastics Catalog. Or, for detailed information about ~~CHILO PLASTICS~~*, piping, tubing and fittings, write for circulars containing data and illustrations.*

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No other material, no other fabricating method can duplicate the eye-pleasing, sales-stimulating properties of molded plastics in the production of this television cabinet.

It's big, all right...big enough to house Admiral's new Super Dyna-Ray tube, "biggest picture in 21 inch TV." Yet its graceful contour reduces the impression of bulkiness. The functionally attractive face plate lends itself perfectly to production by plastics molding. And the cost is low enough to put a take-me-home price tag on the completed unit.

As the pace-makers in big-piece molding, **MPc** offers an unparalleled fund of experience ...unmatched facilities...and the enterprising spirit that welcomes the challenge of new problems. Potential users of large plastic moldings are invited to consult with us. Molded Products, 4535 W. Harrison St., Chicago 24, Illinois.

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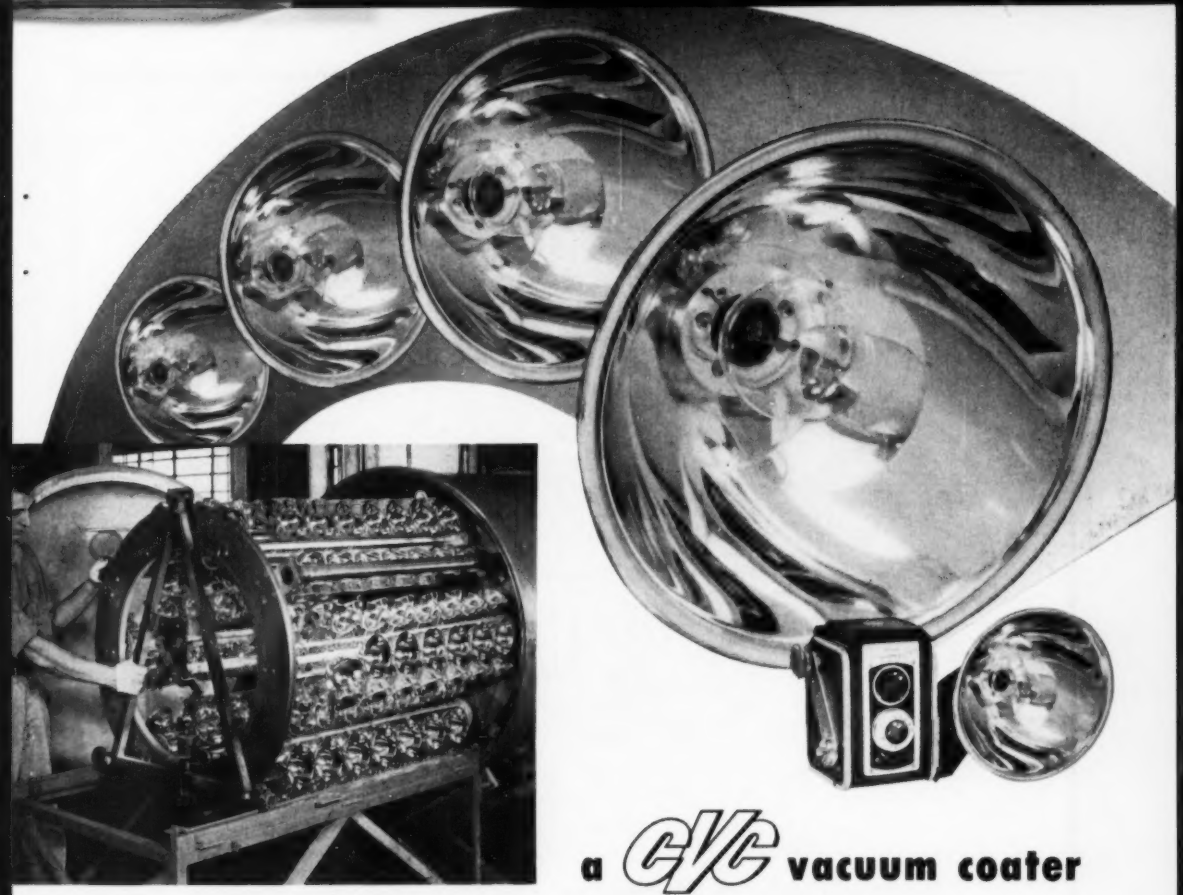

After molding, the Tenite 2(MH Grade) reflector shells are given a lacquer undercoat and placed in a CVC 48 inch horizontal coater (Model LC1-48A). In less than half an hour, they are metallized and ready for another coating of lacquer. (Reliance Varnish Company supplied the undercoat and topcoat lacquers used).

As with all CVC vacuum coating units, this one comes equipped with all necessary controls, is easy to operate, requires little maintenance.

a CVC vacuum coater puts the gleam on a butyrate flash reflector

Most plastics are easy to vacuum metallize. But not all grades of butyrate.

Yet, just recently Eastman Kodak Company set up production of a vacuum metallized butyrate flash reflector using *CVC* equipment. This new development was made possible by using *CVC's* technical knowledge and practical experience in the development program by Eastman Kodak Company.

The result is a reflector with higher reflectivity and better appearance than previous metal models. And, the coating is tough enough to withstand all normal handling.

CVC's experience in high vacuum metallizing and associated lacquering operations is available to help solve your problems. And *CVC* is ready to help you get started in this rapidly growing business with the most efficient vacuum metallization equipment available. For information on this or any other application of high vacuum, write to ***Consolidated Vacuum Corporation, Rochester 3, N. Y.*** (A subsidiary of Consolidated Engineering Corporation, Pasadena, Calif.) Sales offices: Menlo Park, Calif. • Chicago, Ill. • Camden, N. J. • New York, N. Y.

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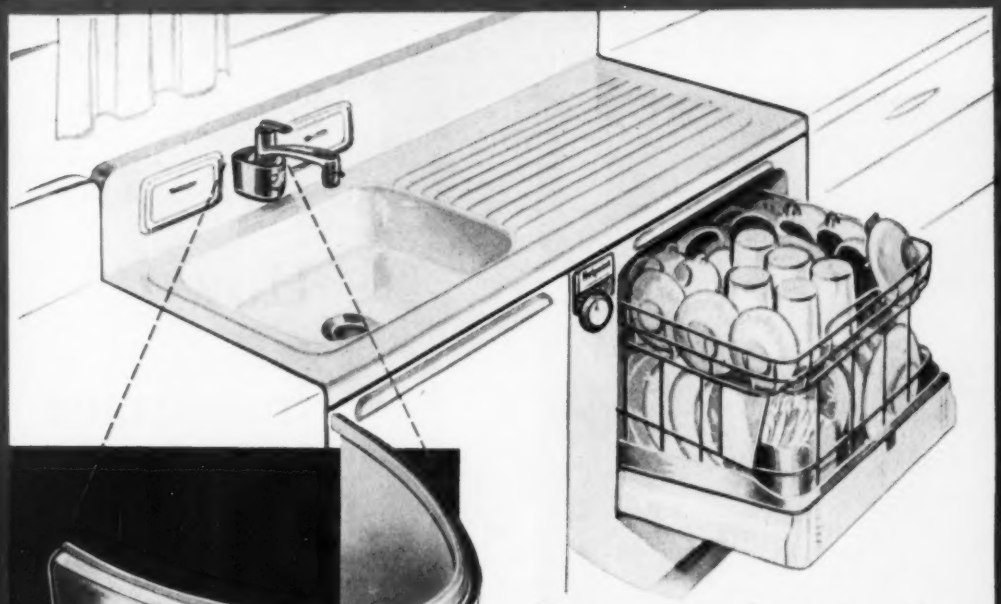

Combination faucet housing and manufacturer's crest molded of PLEXIGLAS V-100 by Cruver Mfg. Co., Chicago.

Chromium housing? Look again... It's molded of PLEXIGLAS

The gleaming faucet housing with projecting crest, on this new Hotpoint combination sink and automatic dishwasher, is metallized molded PLEXIGLAS. By using the acrylic plastic molding powder for the part, designers obtained a notable combination of advantages:

One molding in place of several metal castings. The housing and Hotpoint crest are a single molded unit. No assembly steps are required.

Sparkling color. Brilliant silver and red colors are deposited on the back of the crystal-clear molding where they are protected from damage. For added sales appeal, the Hotpoint nameplate on the dishwasher is also molded of PLEXIGLAS.

Flexibility in design. Multi-curve shapes can be executed without difficulty in this readily molded acrylic plastic.

Serviceability. The resistance of molded PLEXIGLAS parts to heat, hard knocks, and moisture insures trouble-free service through years of daily use.

Product designers and manufacturers in many fields are specifying PLEXIGLAS molding powder for parts requiring attractive appearance plus strength and stability—for both indoor and outdoor use. Our new booklet gives details and suggests applications. Write to the Plastics Department for it today. If you have a specific problem, our design staff and technical representatives will be glad to offer suggestions.

CHEMICALS FOR INDUSTRY

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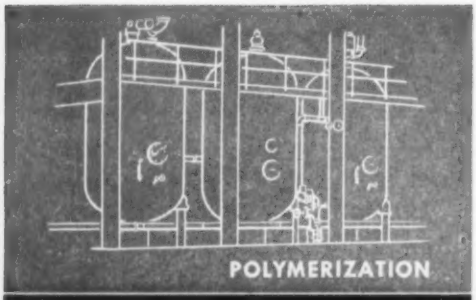
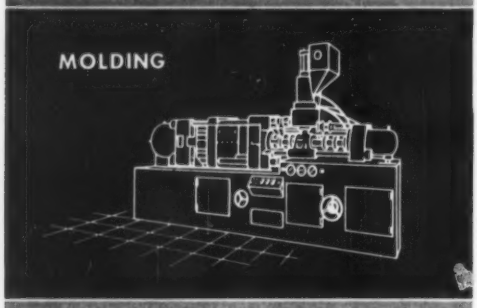
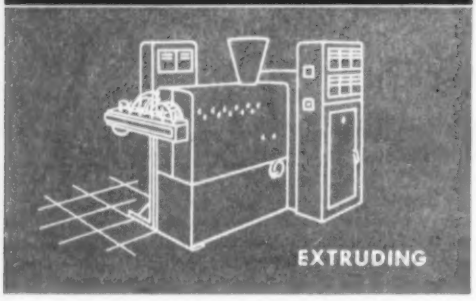
PLEXIGLAS *is a trademark, Reg. U.S. Pat. Off. and other principal countries of the Western Hemisphere.*

CANADIAN DISTRIBUTOR: *Crystal Glass & Plastics, Ltd., 130 Queen's Quay at Jarvis Street, Toronto, Ontario, Canada.*

PLEXIGLAS *Molding Powders are listed in Sweet's Product Design File, Section 1c/Ro.*







How important are instruments to you?

THROUGHOUT the plastics industry, *reliable* controlling instruments are becoming more and more important every day.

For example—in the preparation of plastic molding powders, Honeywell control systems can be relied upon to more effectively keep processes at peak efficiency . . . maintain top production.

And, in molding or extruding, *Pyr-O-Vane* controllers are just as important in the control of temperatures . . . to produce more product, of higher quality, at lower cost.

Whatever your operation . . . polymerization, molding or extruding . . . the quality, price and sales appeal of your product rest heavily on the instruments you use.

With so much at stake, you'll do well to count on Honeywell. Our local engineering representative is well qualified to recommend instrumentation best suited to your requirements. Call him today . . . he is as near as your phone.

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● *Reference Data:* Write for Composite Catalog No. 5000—a handy reference to the complete Honeywell line.

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Take any combination of properties inherent in Spaulding Products. For example, ***electrical insulation*** combined with ***arc resistance, deionizing properties, structural strength, toughness, resistance to wear*** and ***abrasion, good forming*** and ***clean punching***. A manufacturer in the electrical field will visualize at once the many component parts for his products requiring all or a part of this unique combination of properties.

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SPAULDING T BOARD: A superior Transformer Board, in sheets and fabricated parts.

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The table indicates how these two DIAMOND chemicals may be applied in vinyl compounding to produce two-way savings. Specific formulas are available through your nearest DIAMOND Sales Office.

*®

	PARTS	
PVC RESIN	100	100
PRIMARY PLASTICIZER	52	47
*CHLOROWAX 40**	—	15
STABILIZER	3	3
STABILIZER—LUBRICANT	0.5	0.5
*SURFEX**	—	15
TOTAL	155.5	180.5
ESTIMATED MATERIAL COST LB. VOL.	45.8¢	41.6¢
YIELD—% INCREASE PER LB. OF RESIN		11 (By Vol.)
HARDNESS	85A	85A
TENSILE STRENGTH	2600 psi	2600 psi
ELONGATION	375%	375%
100% MODULUS	1400 psi	1400 psi
CRESCENT TEAR	375 lbs. in.	375 lbs. in.
BRITTLENESS—TEMPERATURE	-31 C	-29 C
HEAT LOSS	5.5%	4.7%

DIAMOND SALES OFFICES: New York, Philadelphia, Pittsburgh, Cleveland, Cincinnati, Chicago, St. Louis, Memphis and Houston. Also representatives in other principal cities.

DIAMOND CHLOROWAX 40 AND SURFEX

DIAMOND ALKALI COMPANY...CLEVELAND 14, OHIO

DIAMOND ALKALI CHEMICALS ®

The Windsor R.C.100

TWIN SCREW COMPOUNDER EXTRUDER

MANUFACTURED UNDER L. M. P. PATENTS

Performance—Versatility—Low Operating Costs

Here are some Construction Details

An A. C. commutator variable speed motor is used to drive the screws, which are manufactured from selected alloy steels.

A splined screw design permits easy removal of the working section of the extruding screws. The rear portion of the screws and the thrust washer assemblies are undisturbed.

A new type of flange barrel mounting eliminates tie-rods and hinged adaptor plates facilitate set-up and take-down time. Both these developments make cleaning and adjustments much easier.

A spring-loaded clutch is incorporated in the material feeder so that resistance from foreign particles in the raw material will throw the clutch and prevent damage to the feed mechanism.

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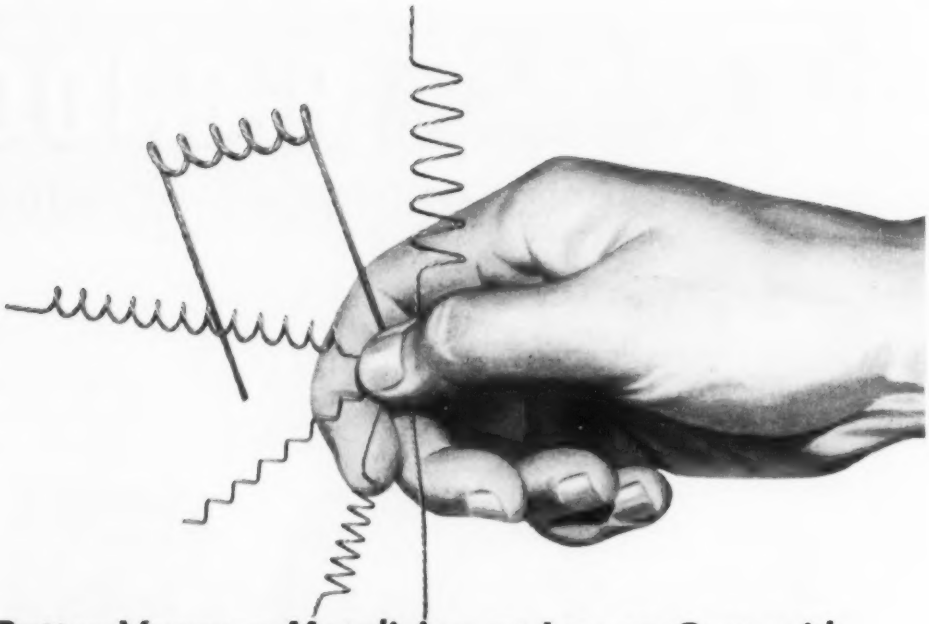

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Sylvania tungsten source heater coils give you maximum performance because they're specially designed to overcome all problem conditions likely to be encountered today.

Because they are made from stranded wire, Sylvania coils have a more effective area for the retention and vaporization of the coating material. They give maximum evaporating capacity for any specific job. They assure a uniform flow of metal . . . in rate, intensity, and direction.

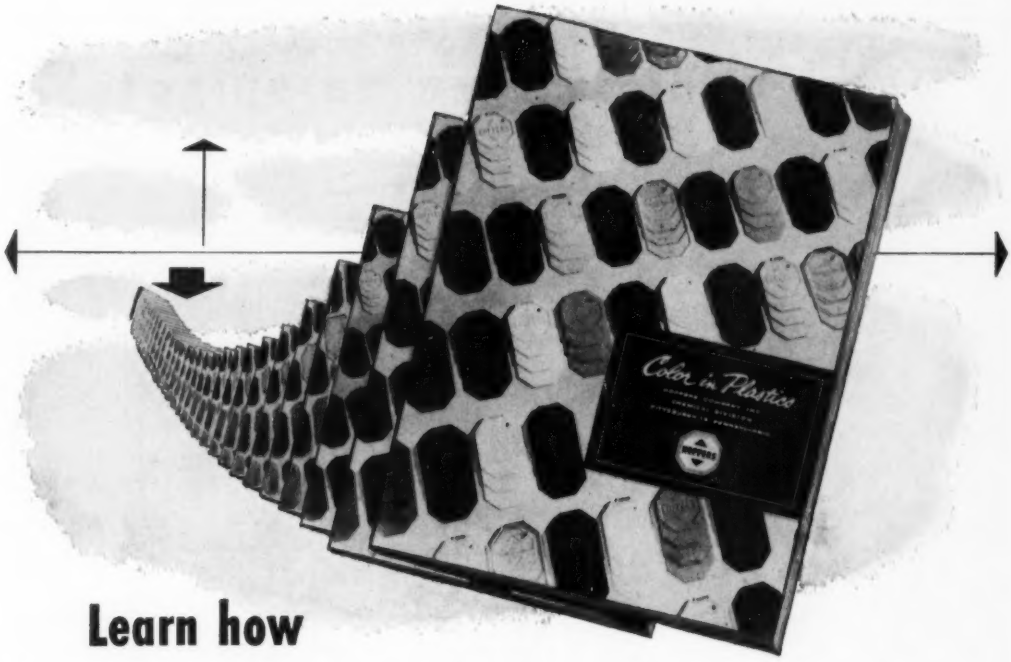
Money-saving, too!

Sylvania tungsten coils save you money because they actually stay on the job longer. The combination of stranding and coiling allows much greater expansion and contraction during the cycle with greatly reduced mechanical breakage . . . giving you more shots from each filament.

A complete line

Now Sylvania offers you a complete line of tungsten coils . . . each designed for a specific metalizing job. Or, if you form your own coils, Sylvania tungsten wire is yours in a full range of diameters, in stranded cable or single strands . . . quality controlled from ore to finished product.

Remember, our engineers are at your service in the solution of any vacuum metalizing problem. New illustrated folder gives valuable suggestions and shows why you'll save money and material with Sylvania's improved tungsten coils. For your free copy, address: Sylvania Electric Products Inc., Dept. 3T-5004, 1740 Broadway, New York 19, N. Y.



Learn how Koppers controls polystyrene's fourth dimension — *Color!*

COLOR is polystyrene's fourth dimension . . . with Koppers polystyrene you can specify the color of your plastic product with the same exactness with which you determine its length, width and thickness.

To help you take full advantage of the most salable feature of polystyrene, Koppers has published a full color book entitled "Color in Plastics." This unique book explains why Koppers polystyrene is visually identical in color from one lot to another over any period of time. This means you are assured of uniform colors in each similar product from first to last; and in products which are molded in two or more parts and then assembled into complete units, you can expect a uniform color match in the several sections.

Most important of all, it means that Koppers can match perfectly any shade of color you are using. If you can see it, we can match it!

For more details about Koppers unique system of color matching, and an authoritative discussion of the Science of Color, write today for your free copy of "Color in Plastics."

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Koppers Plastics Make Many Products Better and Many Better Products Possible.

Koppers Plastics

KOPPERS COMPANY, INC., Chemical Division, Dept. MP-43, PITTSBURGH 19, PA.

SALES OFFICES: NEW YORK · BOSTON · PHILADELPHIA · CHICAGO DETROIT · LOS ANGELES

Okay Louie...turn da spigot

It's fun to laugh at primitives...unless *you* happen to be paying the bill.
Although Boonton's been in the business of molding plastics
since flappers pranced around in short skirts, we've always prided ourselves
on using the most modern and efficient equipment available.
That way, we get a greater return for our capital dollar and you get
a greater return for your purchasing dollar. Makes sense, doesn't it?

BOONTON MOLDING CO.

BOONTON, NEW JERSEY

NEW YORK OFFICE — CHANIN BUILDING, 122 EAST 42ND STREET, MURRAY HILL 6-8540

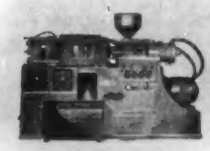
Now...Up to 40 Color Changes in 24 Hours

A Standard Fellows Injection Molding Machine Proves its Versatility In Production Quality Control

One of America's leading plastic materials' manufacturers (probably one of your prime suppliers) has selected the Fellows 1B-3-15 for quality and color control of their molding materials.

The reason? Fellows exclusive "Speed-Flo" design feature gives quality moldings, plus fast purging for more rapid, less costly color changes. And—new set-ups are made with a minimum of down time.

This fast changeover and super-control, coupled with compact design and low maintenance, can make Fellows Plastics Molding Machine your best bet, too. So, if you want quality plus speed, investigate the versatile Fellows 1B-3-15 now!



Fellows
injection molding equipment

THE FELLOWS GEAR SHAPER COMPANY, Plastics Machine Division, Head Office and Export Department, Springfield, Vermont
Branch Offices: 323 Fisher Bldg., Detroit 2, Michigan • 5835 West North Avenue, Chicago 39, Illinois • 2206 Empire State Bldg., New York 1, N. Y.

You saw this ad in Tool Engineer, Machinery, Modern Machine Shop, American Machinist, Iron Age...

CRUCIBLE MOLD STEEL is TOOL STEEL

You profit because mold steels are tool steels at Crucible. Our reputation as specialty steel leaders was built with tool steels.

That means you get all the experience of more than half a century of tool steel leadership when you buy mold steel from Crucible.

Crucible mold steel *is* better—because it's tool steel. And you'll find mold steel stock in strategically located warehouses from coast-to-coast.

WRITE TODAY FOR YOUR TOOL STEEL SELECTOR

Get your copy of the unique Crucible Tool Steel Selector — a quick twist of the dial gives you the right tool steel for the right job. And the selector picks mold steel, tool 9-inch diameter; printed in 3-colors.

CRUCIBLE first name in special purpose steels

53 *years of Fine steelmaking*

MOLD STEEL

CRUCIBLE STEEL COMPANY OF AMERICA • TOOL STEEL SALES • SYRACUSE, N. Y.

AMOS EXPANDS AGAIN . . . .

TO SERVE *you* BETTER

Established in 1939, Amos Plastics Division was moved to then new plant (1) in 1945 . . . with rapid expansion continuing . . . (2) in 1948 . . . (3) in 1950 . . . (4) in 1951 . . . and (5) under construction for occupancy about July 1, 1953.

▶ **Growth through service** continues at AMOS . . . with another major step in a long-range expansion program . . . giving *added meaning* to the well-deserved appellation:

"Today's *most modern, best-equipped* injection molding plant . . . centered in the *rich heartland* of Midwest industry."

Pioneers in new applications—and employing the results of continuing research—AMOS provides *complete service* . . . product design and engineering . . . mold building . . . molding with 4 to 300 ounces machine capacity . . . conveyorized assembly and finishing—vacuum plating, multi-color painting, printing, hot stamping, silk screening—for simple beauty or complex decorative effects.

Ever-growing AMOS invites *new* business . . . *new* opportunities to please customers with plastics jobs that are handled RIGHT . . . from start to finish . . . no divided responsibility.

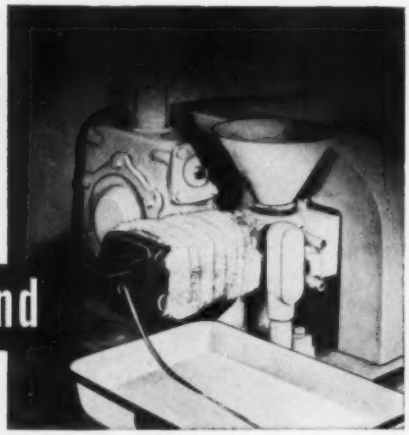
We invite YOU to write, wire or call: **AMOS MOLDED PLASTICS, Edinburg, Indiana** • *Offices: New York, Chicago, Detroit, Philadelphia, Nashua, N.H.*

Amos
MOLDED PLASTICS, Inc.
Custom
Injection Molding Specialists

In the Heart of the Industrial MIDWEST

METASAP* STEARATES

...and



superior lubricants in molding compounds

outstanding thickeners for plastisols

Metasap Calcium and Zinc Stearates are unsurpassed as lubricants — in molding compounds, or when dusted onto surfaces of mold cavities. Molders using them eliminate preform delamination, and breakage of finished products, because all *ejection pressures are minimized.*

If the importance of economy cannot be overemphasized in your compression molding, you'll find *nothing more profitable* than Metasap stearate lubrication. Metasap Calcium and Zinc Stearates will assure improved preforms, improved finished products, and increased output *at less cost.*

If you manufacture plastigels, look to Metasap Stearates. Not only have these quality metallic soaps proved *successful gelling agents,* but their *ready availability* and *basic economy* offer advantages you cannot afford to overlook. We'll be pleased to provide samples of —

Metasap Magnesium Stearate
Metasap Barium Stearate
Metasap Calcium Stearate
Metasap Aluminum Stearate

at no cost and without obligation, to help you select just the thickener, or thickeners, you find best for the plastisols you are handling.

*Reg. U. S. Pat. Off.

For complete information, write
METASAP CHEMICAL COMPANY, HARRISON, N. J.
Chicago • Boston • Richmond, Calif. • Cedartown, Ga.

METASAP CHEMICAL COMPANY
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Stearates

of Calcium • Aluminum • Lead • Magnesium • Zinc

Gering is Geared TO SERVE THE ENTIRE PLASTICS INDUSTRY

a complete **PLANT**

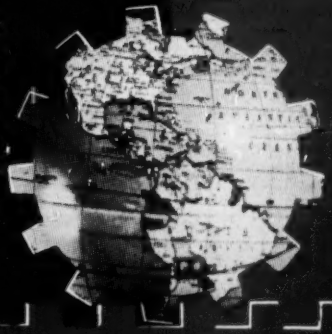
for a complete **SERVICE**

WE MANUFACTURE Virgin Thermoplastic injection and extrusion molding compounds, standard and special formulations . . . Polystyrene, Polyethylene, Acetate, Acrylics, Ethyl Cellulose, Vinyls.

- **WE BUY THERMOPLASTIC SCRAP** — all types and forms: Polystyrene, Vinyls, Nylon, Ethyl Cellulose, Polyethylene, Acetate, Butyrate, Acrylics.
- **WE CUSTOM COMPOUND** your materials, and offer these special services: Sorting, De-contaminating, Color-Matching, Pelletizing.
- **WE EXTRUDE** any flexible or rigid formulation which you plan, for any special-shaped Belting, Binding, Edging, Rods, Tubes, Film, Strips . . . in Polystyrene, Cellulose Acetate, Polyethylene, Vinyl, Butyrate, Ethyl Cellulose, Acrylics.

DRYCOL —offered as Gering's perfected dry coloring medium for in-plant coloring of ALL PLASTICS. No special skill or equipment needed. Standard, Special and Metallic colors available or to order.

Our service is world-wide . . . attained over the years thru eternal self-discipline for Quality, Perfection, Delivery. Consult our Technical Service Department.



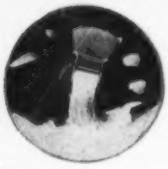
Our 28 years' experience and large facilities at your service. Your guarantee of complete satisfaction.

GERING *Products* INC. KENILWORTH, N.

STURTEVANT DUSTLESS BLENDERS

Thoroughly Blend Substances into an Inseparable Mass

The 4-Way Mixing Action of the Sturtevant Dustless Blenders thoroughly mixes two or more substances into an inseparable whole . . . every part of which is the same analysis. Single receiving and discharging opening insures tight sealing during mixing process. "Open-door" accessibility permits thorough cleaning. The fast, accurate mixing operation increases output . . . cuts mixing costs. Available in many sizes with mixing capacities from ¼ ton to 75 tons per hour. Write for information and catalog.



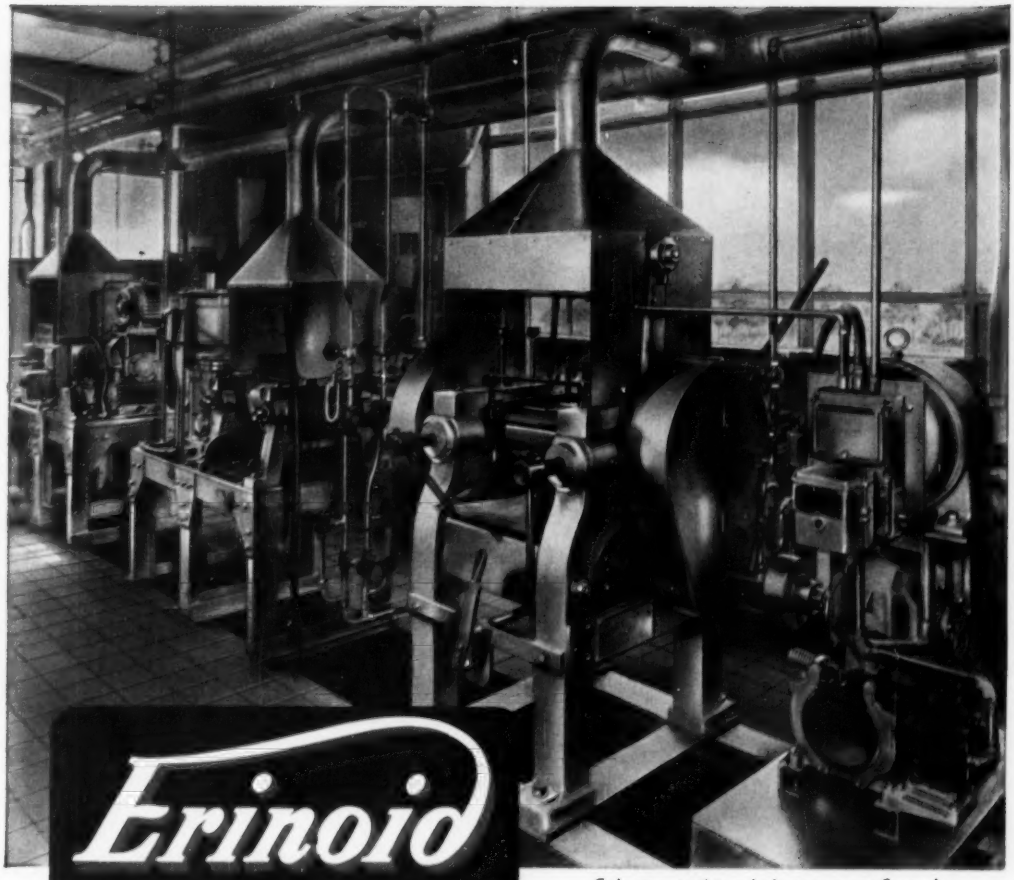
Receiving — The ingredients to be mixed enter the mixing chamber of drums through a chute. Note scoops which carry up and dump the ingredients as drum rotates assuring a more uniform mix.

Discharging — Throwing a lever closes the inlet and mixer is in discharging position. The completely mixed materials drop off the lifting scoops and discharge through chute without segregation of ingredients.

The Sturtevant Mill Company

110 Clayton Street, Boston 22, Massachusetts

Designers and Manufacturers of: CRUSHERS • GRINDERS • SEPARATORS • CONVEYORS • MECHANICAL DENS and EXCAVATORS • ELEVATORS • MIXERS



Colour-matching Laboratory at Stroud

for **Polystyrene**

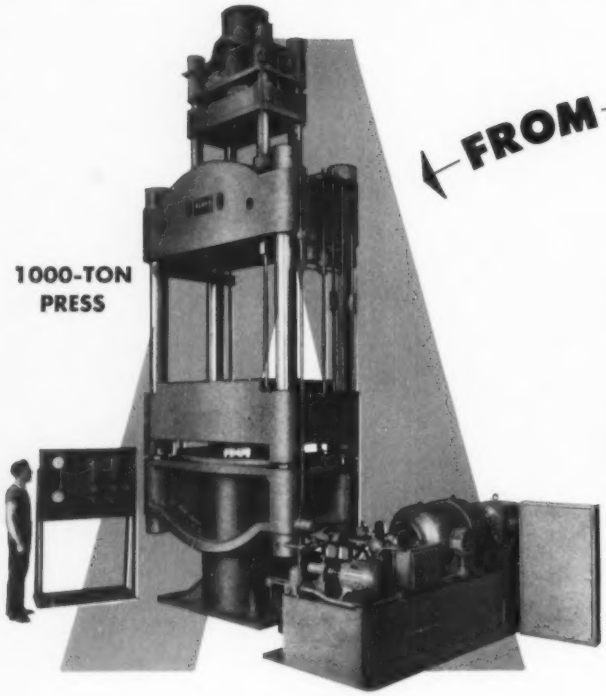
and

CELLULOSE ACETATE

Moulding Powders

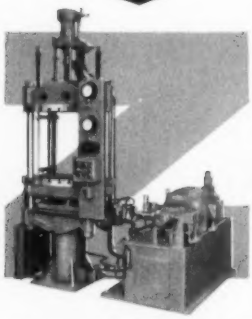
ERINOID LIMITED · STROUD · GLOUCESTERSHIRE

ELMES Covers the Compression and Transfer PLASTICS MOLDING FIELD



FROM

TO



Installation of 50-Ton Press (Lab Use) makes the 20TH ELMES MOLDING PRESS IN ONE LOCATION

The most sincere testimonial any manufacturer can receive attesting to the worth of his product is a *re-order*. Consequently Elmes was justifiably proud when the *20th* Elmes Plastics Molding Press was ordered for installation in this one location.

This story not only reflects the reliability of Elmes Press performance; it is another excellent example of how Elmes meets customer requirements *exactly*. For the new 50-ton Press as well as the 1000-Ton Press illustrated —and *many others* in the battery of 20 presses—are special adaptations of *standard* Elmes designs . . . "custom built" to meet specific job requirements.

Take the 1000-Tonner, as an example. Designed for both near and remote control, this press has two push-button control panels—one (shown in photo) situated close to the press, the other in a separate room. The flick of a switch changes this press from straight compression to transfer molding. On the compression cycle, the circuit is arranged to provide two breathe periods. Curing is set by a motor-type timer and can be furnished with any required range. Lower knockout is hydraulically operated and is *fully automatic*. And these are but a few of the many features.

Whatever your molding requirements—for a press of entirely new design, of modified design, or of standard design—Elmes is your assurance of complete press satisfaction. Recommendations and cost estimates are yours for the asking.

American Steel Foundries

ELMES ENGINEERING DIVISION

1159 TENNESSEE AVENUE CINCINNATI 29, OHIO

DISTRIBUTORS IN PRINCIPAL INDUSTRIAL CENTERS —— ALSO MANUFACTURED IN CANADA

METAL-WORKING PRESSES • PLASTIC-MOLDING PRESSES • EXTRUSION PRESSES • PUMPS • ACCUMULATORS • VALVES • ACCESSORIES

DESIGN and PRODUCTION NEWS

FOR PLASTICS AND MATERIALS ENGINEERS

Published by TECHNICAL SERVICE, Chemical Manufacturing Division, The M. W. KELLOGG Company APRIL 1953

Unique Hose Incorporates KEL-F* to Handle Highly Corrosive Oxidants

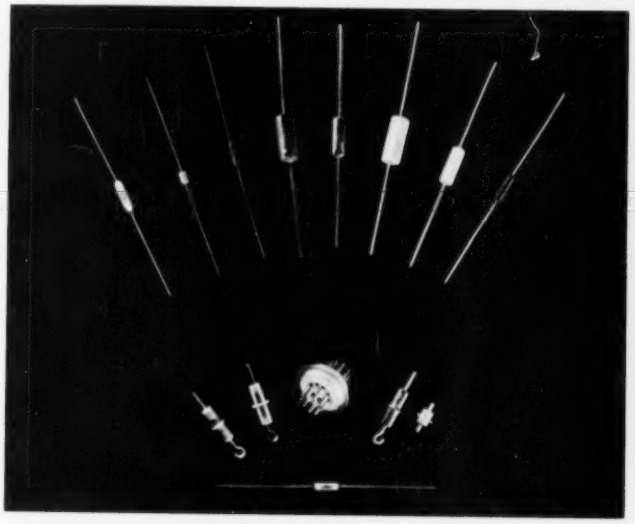
This new hose, employing tubing made from Kel-F* trifluorochloroethylene polymers, not only carries white fuming nitric acid and 90% hydrogen peroxide but also takes other remarkable punishment without failure. The core of the hose, a smooth extruded seamless tube of Kel-F plastic, remains unaffected in spite of constant contact with the acid or peroxide under pressure . . . at freezing as well as boiling temperatures . . . absorbs vibration without fatigue failure . . . stays tough but flexible at low and high temperatures.

Resistoflex Corporation of Belleville, N. J., produced this "super" hose for Air Force contractors, drawing on its long experience in high-pressure and specialty hose manufacture. It is currently producing armored hose, incorporating tubing made of Kel-F, in $\frac{1}{4}$", $\frac{3}{8}$", $\frac{1}{2}$" and $\frac{3}{4}$" I.D. sizes to specified lengths, with other sizes planned to meet demands of both industry and the military.

Mechanical-type, corrosion-resistant alloy steel pressure fittings are employed and a specially-designed high tensile, high density armor braid of steel surrounds the plastic tube for added protection. The entire assembly is lighter and less bulky than feedlines formerly used for this purpose due to the new type "armor" braid and to two other factors—(1) the smooth internal walls of the extruded tube and its high strength allow the use of smaller tubing for a specific flow, and (2) consequently smaller fittings.

In addition to this newly developed product, Resistoflex extrudes, molds and machines a wide variety of other parts for corrosive service, high and low temperature processes, and electrical uses where the unique combination of properties of Kel-F are required.

Refer to Report C-103



Terminals with KEL-F* Plastic Insulation Feature 10^6 Megohm Insulation Resistance...and Minus 94° F. to 390° F. Range!

With true hermetic seal characteristics these terminals will bear rough production handling and still pass a 7 pound terminal pull test and a 10 inch ounce torque test on the central conductor. Combine this with the high insulation resistance, broad temperature utility and mechanical strength of Kel-F in the body, and you have a solder-seal type terminal that stands out among all others.

Manufactured by the International Resistance Company of Philadelphia, Pa., this "Type HS-1" terminal (pictured at right) achieves its high rating through the use of insulation injection molded of Kel-F and a special process developed by this company to obtain a plastic-to-metal bond of remarkable strength. Employing highly dielectric and inert Kel-F polymers as the insulation in this terminal, International has overcome limitations associated with similar type terminals: low corona breakdown voltage, electrolysis under high DC voltage, failure under thermal shock.

The molded Kel-F is inert to acids, alkalis, oils, vapors and most organic solvents—thereby extending its usefulness to many processes and industries. Consistent, dependable, performance is assured in humid installations — insulation molded of Kel-F has zero water absorption, sheds water, precludes formation of fungus.

International Resistance Company molds and extrudes Kel-F polymer in many forms to serve many phases of the electrical and electronic industry. The main illustration includes several of the current applications, as well as others in the testing stage, among them press-fit insulated terminals . . . resistors with bodies molded of Kel-F . . . similar items in which the Kel-F is loaded with mica and silica . . . miniature insulated feed-through terminals . . . injection molded multiple header for hermetic seal use . . . selenium rectifier employing parts of Kel-F. Work is also continuing on development of unusual types of electrical materials which take advantage of the unique electrical and physical properties of Kel-F alone, or in combination with other materials.

Refer to Report E-104

(SEE REVERSE SIDE)

* *Registered trademark for The M. W. Kellogg Company's trifluorochloroethylene polymers.*

KEL-F FLUORO CHLORO CARBON PLASTIC
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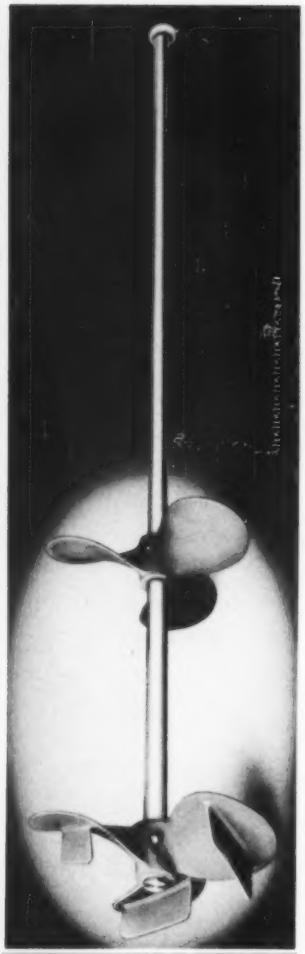


Agitator Coated with KEL-F* Dispersions Permits Inert Pharmaceuticals Processing

Even high-quality alloy steel and customary platings and coatings could not provide the absolute chemical *inertness* obtained by coating this agitator assembly with Kel-F* trifluorochloroethylene polymer. The smooth, tough but flexible coating had no effect on the quality of sensitive vitamin and intravenous solutions processed in 50- and 200-gallon batches. The Kel-F coating, 0.010" thick, offers an unbroken, smooth, non-porous surface which prevents any contact between process solutions and the agitator's alloy steel even during prolonged processing phases. The non-stick characteristics of the Kel-F polymer preclude the adherence of any process material to contaminate subsequent batches.

Some of the materials processed are neutral. Others are slightly alkaline or acidic, such as a blood anti-coagulant preparation with a pH of 4. Processing temperatures range from 140° F. to 185° F., the upper limit being used for preparation of intravenous solutions which require the inversion of sucrose to glucose.

General Plastics Corporation of Clifton, N. J. coated the agitator assembly consisting of two 10" diameter blades on a 6' shaft unit. The alloy steel paddles and shaft, after preliminary grit blasting, are given successive coats of Kel-F NW-25 dispersion. Each coat is cured in a gas-fired or electric oven at temperatures up to 500° F. After the final coat is applied, the assembly is oven cured at similar temperatures for from one to twenty-four hours. During this "bake" the coating takes on a glass-like smoothness and shine which General considers important to the coating's durability and effectiveness.

General Plastics Corporation has successfully applied protective coatings of Kel-F dispersions by spray methods to many other classes of equipment including blowers for corrosive gases, release coatings on drying pans, and liquid indicator floats. General soon expects to be able to handle parts with an overall length of 18 feet, and widths up to 6 feet.

Refer to Report C-104

New Technical Bulletin on Properties Issued...

Kel-F Technical Bulletin #1-12-49, has just been revised and reissued as #1-3-53. The new edition of the bulletin contains expanded data on physical properties including a table of Chemical Resistance to more than 100 specific chemical substances... two new tables on Permeability ... also new data on Light Transmission in both the visible and ultra-violet spectrums.

If you have not received your copy, just drop a card or note to Technical Service.

Molders of the Month

Leading molders and extruders specialize in fabrication of materials and parts made of Kel-F . . . each month this column will spotlight several of these companies with their principal services and products.

American Phenolic Corporation
Chicago, Ill.
Kel-F Coated Wire, Cable,
Injection Molding

Crane Equipment & Supply Company, Inc.
Waterbury, Conn.
Kel-F Dispersion Coatings

Flek Corporation
Los Angeles, Cal.
Injection, Compression and Extrusion Molding
Electronic Sealing of Film
Dispersion Coating

Insulating Fabricators of New England, Inc.
Watertown, Mass.
Fabrication of Parts From Sheet, Rod, Tubing
Machining, Engraving, Stamping, Punching, Polishing of Parts

Linear, Incorporated
Philadelphia, Pa.
Compression Molding
"O" Rings, "U" and "V" Packings, Gaskets, etc.

The Polymer Corporation of Pennsylvania
Reading, Pa.
Extruded Tape, Strip
Molded Rods, Beading
Extruded Rods

For complete information regarding any item mentioned in DESIGN AND PRODUCTION NEWS, ask for detailed APPLICATION REPORTS, write

Technical Service
CHEMICAL MANFACTURING DIVISION
THE M. W. KELLOGG COMPANY
P.O. Box 440, Jersey City 3, N. J.
or offices in New York, Chicago, Los Angeles.
M W KELLOGG PULLMAN

* *Registered trademark for The M. W. Kellogg Company's trifluorochloroethylene polymers*

molds made in minutes

by fast, low-cost metallizing process

For low-pressure, vacuum, slush and lay-up molding.

Metallizing, the spraying of molten metal, is now being used for the production of molds for low-pressure, vacuum, slush and lay-up processes, in a wide range of mold sizes—some lay-up types as much as 30 feet long. These metal molds are made quickly, at low cost; masters may be of metal, cloth, wood, plastic, glass, or even wax. Finest detail is retained and mold life is practically indefinite. Part spoilage, "break-out" and patching or other maintenance on lay-up molds are eliminated; improved heat transfer, better curing, assure void-free parts.

Metallizing gun building up metal mold directly on plaster master

Finished mold. Note fine detail. Spraying time 28 minutes.

MODERN PLASTICS *article describes method*

The article, "SPRAYED METAL MOLDS," by *Dr. Walter Brenner* and *Leopold Hase*, of Polytechnic Institute, which appeared in the September MODERN PLASTICS, described the process in detail. We will be happy to send you a reprint of this article on request. Use the handy coupon.

Don M. Watson
METALLIZING ENGINEERING CO., INC.
38-14 30th Street
Long Island City 1, N. Y.

☐ Please send me free reprint of MODERN PLASTICS article: "SPRAYED METAL MOLDS."

☐ Please have Metco Field Engineer call.

NAME_____

COMPANY_____

STREET_____

CITY_____ ZONE____ STATE_____

METALLIZING ENGINEERING CO., INC.
38-14 30th Street — LONG ISLAND CITY 1, N. Y.
In Great Britain: METALLIZING EQUIPMENT COMPANY, LTD., Chobham near Woking, England

Always asking "what's new"

—these millions of families with BUY on their minds!

FIND THE PEOPLE who seek new ways to make living more pleasant, and you find the best plastics customers. In Better Homes & Gardens you find 3¾-million families like these!

The reason? BH&G screens the nation to attract *only* such families. Every article, every illustration is carefully planned to stimulate its readers' desiring power—by showing them what they need, what to buy—to make their homes better homes.

Naturally, in this BUY-minded atmosphere, any plastics ad attracts more attention—and more sales!

BH&G BUYOLOGICAL BRIEFS

- *MORE DOLLARS OF ADVERTISING, more lines of advertising & more pages of advertising were placed in BH&G in 1952 than in any other major monthly magazine.*
- *PLASTIC COVERS for appliances are owned by over 50% of BH&G families, according to a recent survey.*
- *8 OUT OF 10 BH&G FAMILIES have one or more pieces of plastic-upholstered furniture.*

MEREDITH PUBLISHING COMPANY
Des Moines, Iowa

Tupper Seal, air and liquid tight flexible covers fit, and are included in the sets of all Tupperware Canisters.

The Tupperware 50 oz. Canister is "standard equipped" with the Tupper Seal, air and liquid-tight flexible Pour All cover.

The Tupper Seal, air and liquid-tight flexible Pour All cover is used on every Tupperware 20 oz. Canister.

The Tupper Seal, air and liquid tight, Pour All cover as a cover for 46 oz. cans; Tupperware Sauce Dishes and other containers of metal, glass or pottery. Foods easily dispensed without removing entire cover.

The Tupperware Wonder Bowls are usually fitted with Tupper Seal, air and liquid-tight covers.

Argentine Patent 74,095 dated Dec. 14th, 1949 on invention covered by U. S. Patent 2,487,400 November 8, 1949. Canada Patent 463,387 Feb. 28th, 1950. Union of So. Africa Pat. 8,592 Sept. 21st, 1949. Belgium Pat. 491,293 Oct. 15th, 1949. Switzerland Patent 48,970 Sept. 23rd, 1949. Italy Patent 456,937 September 19th, 1949. Germany Patent 829,248 September 25th, 1949. Great Britain Patent 662,219 September 27th, 1949. Argentina Patent 96,970 September 30th, 1949. Brazil Patent 39,676 December 29th, 1951. Mexico Patent 51,615 January 3rd, 1952. Other U. S. and Foreign Patents Pending.

TUPPER / Seals

air and liquid-tight, flexible covers for Tupperware Tumblers, Canisters, Wonder Bowls, Cereal Bowls and many another container of glass, metal and pottery, the contents of which it is desired to keep fresh and wholesome.

TUPPER /

FORMAL NOTICE! 9th November, 1949

EXCLUSIVE!

U. S. Patent #2,487,400

The Tupper Corporation has attained a position of leadership in this industry by incurring great expense and expending painstaking effort in the development, design, manufacture and exploitation of its many world-known products.

The Tupper Corporation further has anticipated the inevitable attacks to which leadership is subject and has taken measures provided by law to preserve the creative rights to its products, methods and design by patent protection both in the United States and abroad.

Tupper Seals for Tupperware shown in this advertisement are just a few of the forms covered in this manner and are specifically covered by U.S. Patent #2,487,400.

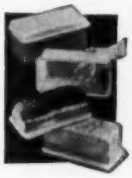
Only the Tupper Corporation, by U.S.Patent #2,487,400 has the right to make, use and vend container closures in connection with any and all types of containers throughout the United States and its territories as covered by the claims of the Patent.

Tupper Corporation will protect, according to law, the exclusive rights above granted

TUPPER CORPORATION

There's a Tupper Seal, air and liquid-tight flexible cover for Tupperware 2, 5, 8 and 12½ oz. Tumblers too, and these Tupper Seal, covers fit many other containers of metal, glass and crockery.

The Tupper Seal, air and liquid-tight flexible Pour Top cover, specially designed as a dispensing cover for specified diameters of containers holding foods such as syrups, salad dressings, catsup.



The cover of the Tupperware Bread Server which serves as a bread tray also is designed to give similar results as Tupper Seal, air and liquid-tight Flexible covers. Keeps contents fresh as no other such container.

When equipped with Tupper Seal, air and liquid-tight, flexible covers, Tupperware Cereal Bowls serve many another purpose.

The Tupper Seal, air and liquid-tight flexible cover made for Tupperware 8 oz. Tumblers also fits and is sold with all Tupperware Funnels as a base when funnels are used as storage containers.

TUPPER CORPORATION

Manufacturers of — CONSUMER, INDUSTRIAL, PACKAGING AND SCIENTIFIC PRODUCTS

Factories, Laboratories and Sales Offices: Farnumsville, Mass., Orlando, Fla., L'Epiphanie, P.Q. Showrooms: 225 Fifth Ave., N. Y. C.

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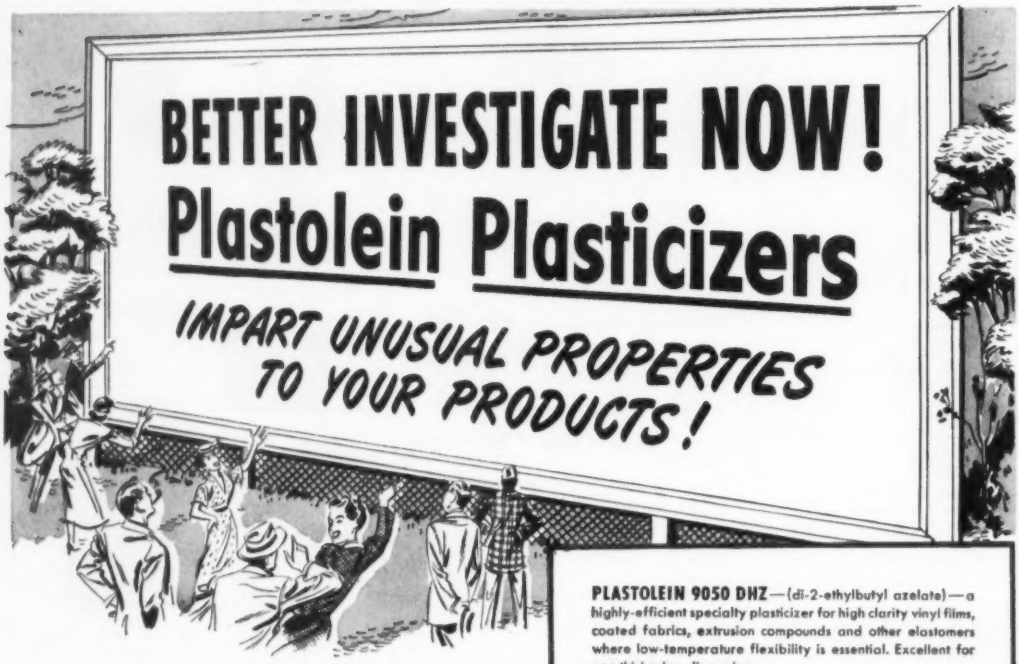

Expanded facilities to triple production

You can plan now with assurance that by mid-1953, Emery's revolutionary ozone-oxidation process will greatly increase the availability of the Plastolein Plasticizers as well as exclusive Azelaic and Pelargonic Acids.

If you are not already using a Plastolein Plasticizer, start an evaluation today. Their lower costs will result in the increased use of certain of these products as basic vinyl plasticizers. Others will be very attractive as specialty plasticizers. All are noted for their low temperature properties, stability to heat and light, low water and oil extraction, low volatility, and excellent "hand" and drape.

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PLASTOLEIN 9050 DHZ—(di-2-ethylbutyl azelate)—a highly-efficient specialty plasticizer for high clarity vinyl films, coated fabrics, extrusion compounds and other elastomers where low-temperature flexibility is essential. Excellent for non-thickening dispersions.

PLASTOLEIN 9058 DOZ—(di-2-ethylhexyl azelate)—a good all around basic plasticizer that also imparts excellent low temperature properties. Its outstanding combination of properties leads to its use in any vinyl product. Also advantageous for nitrile and GR-S rubbers.

PLASTOLEIN 9055 DGP—(diethylene glycol dipelargonate)—a general purpose auxiliary plasticizer for imparting low-temperature flexibility, excellent "hand" and drape to vinyls. Also, an outstanding low-temperature plasticizer for Neoprene and Buna-N rubbers.

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PLASTOLEIN 9715, 9720 POLYMERIC—These Polymeric Plasticizers impart extreme durability and weatherability to vinyl materials, yet exhibit the low-temperature characteristics and high efficiency of most monomeric plasticizers. Prolonged exposure to heat and ultraviolet light does not result in appreciable discoloration, stiffening, or sweat-out.

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MODERN PLASTICS

APRIL 1953 VOL. 30, NO. 8

Scientific Sampling

Statistical Quality Control is a production tool for the plastics industry. It gives the alarm when a production line deviates from a desired quality level

by Robert K. Mueller*

Courtesy C. F. Church Mfg. Co.

In Statistical Quality Control, each sample measured reflects the quality of a predetermined portion of production. Statistical Quality Control not only reduces waste in material and man-hours in production but it also serves to speed up inspection

FOLLOWING the end of World War II, industry moved quickly and with acknowledged success to convert military production lines to peace-time use. Another conversion has been taking place at the same time, but more quietly and not quite so rapidly—the conversion to peace-time practices of ideas and methods developed by the scientists and based on mathematics.

One of these scientific procedures is making headway in the plastics industry. It is a manufacturing technique for improving and controlling quality, a system that has been successful in many fields—from making plastic fountain pens and refrigerator parts to raising chicks and testing artillery pieces.

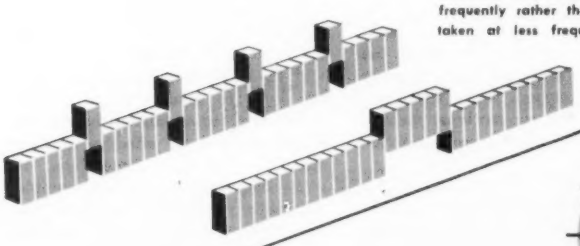
At Esterbrook Pen Co. and Consolidated Molded Products Corp., to take two examples, quality control methods using easily available statistics have been applied successfully.

Statistical quality control adds up to economy in the following ways:

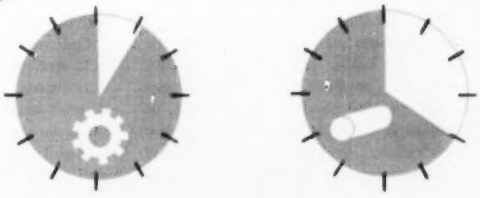
Reduction of scrap and rejects.
Reduction of wasted machine man-hours.
Increased productivity.
Thriftier use of materials.
Identification of design defects.
Simplification of production planning.

* See "The Author," p. 81.

Closer control of quality is provided by small sample lots taken frequently rather than large lots taken at less frequent intervals



Design, desired tolerances, and end use of product determines time intervals between samples



1 In Statistical Quality Control procedure, inspector takes 10 pieces from parts produced during the preceding hour of machine operation

2 Inspector then measures each of the sample pieces taken from production and records the results on Work Sheet and Control Chart

3 Final inspector checks sample pieces against specifications to hold production quality within acceptable and specified limits

4 If the number of defects is found to be within allowable limits, entire lot is accepted. If not, entire lot is then 100% inspected

Although based on statistics, on higher mathematic principles, only a few simple formulas are needed to give the alarm when the production line deviates from the desired quality level. Once set up, the system requires a minimum of management attention, no special equipment, and only a modicum of common sense.

What It Is

Statistical Quality Control is the formal title given to the system by the engineers who also explain it as a means of measuring differences—the pattern of variations in size that occur as the production line operates. The system focuses attention on the production line as it builds, or fails to build, the desired quality into the product. It spots changes that may be needed in the mold, in machine adjustments, or in the raw materials. And it does it almost immediately—not after hundreds of faulty or defective units have been produced.

The first step in the system is to fix quality limits. Blueprint specifications and customer demands usually determine this factor.

Next, the capability of the equipment and the process to meet the quality level is determined. Normally, this requires a tedious examination, piece by piece, of the sheet, film, or molded part as it leaves the machine. To learn the frequency with which changes occur in size, dimension, and other characteristics, the conventional method is to sort and classify each individual item.

One of the immediate advantages of a statistical control system is that it requires the measurement of only a small number of pieces. The sampling procedure is devised mathematically to provide faster, easier, and more effective information.

Instead of sorting, measuring, and classifying successive pieces, small sample lots—perhaps five pieces at a time—are taken off the line at intervals. Each sample is inspected and deviations from the quality standard are recorded on a work sheet and on a control chart. As production moves, these records give a composite picture of the quality level of the entire work lot.

Sample size—in number of pieces or square inches—and the method and the frequency of sampling are the keys to quality control. Five pieces selected at random have been found to give an effective sample size for checking dimensions or other characteristics. Small sample lots, selected at short intervals, are preferred over larger, less frequent samples. Frequently it is possible to reduce the size and frequency of sampling after a definite pattern has been established.

Sampling will vary, naturally, with the degree of precision required. If the molded piece is a molded gear for a computing device, tolerance factors may be of vital importance and sampling may be required more often than for a household item.

The method of sampling should be consistent. A common practice is to use the clock method and take five units directly from the machine at prescribed intervals. Thus a record is maintained of the condition of the machine, material, and process at definite time periods. In this step alone, substantial savings can be made in testing or inspection programs.

At Esterbrook Pen, the study of the machining operation to determine the capabilities of the process yielded dramatic results. The company was seeking to maintain in routine production a press fit between "tip" and "barrel" sections of a fountain pen. The inspection procedure involved 100% gaging of tips, sorting by sizes, and selective fittings in each barrel. Despite the sorting operation, the company was experiencing an average range of 5 to 10% refitting.

TABLE I
Table for Calculating the Limits of "Averages and Range" Control Charts

Number of Observations in each subgroup	A_2	D_3	D_4
2	1.880	0	3.267
3	1.023	0	2.575
4	0.729	0	2.282
5	0.577	0	2.115
6	0.483	0	2.004
7	0.419	0.076	1.924

For the "Averages" Chart:

Lower Limit = $\bar{\bar{X}} - A_2\bar{R}$

Center Line = $\bar{\bar{X}}$

Upper Limit = $\bar{\bar{X}} + A_2\bar{R}$

For the "Ranges" Chart:

Lower Limit = $D_3\bar{R}$

Center Line = $\bar{R}$

Upper Limit = $D_4\bar{R}$

Where:

$\bar{X}$ = Average of each subgroup

R = Range within each subgroup

$\bar{\bar{X}}$ = Average of all the $\bar{X}$'s

$\bar{R}$ = Average of all the R's

Application of statistical control methods uncovered vital information: 1) Engineering specifications were not set at the best levels for trouble-free operation. 2) Screw machines were capable of producing more uniform diameters than were being realized in actual production.

Anticipated Troubles

Under the old methods, the company anticipated trouble with up to 10% of its production. By correcting the operating defect disclosed in the process capability study, the anticipated trouble was cut to about 2 percent.

Other improvements followed. They included elimination of selective fitting at assembly and complete interchangeability of parts, greater tool service due to less adjustings and replacements, and a savings of $4000 a year in direct labor alone. As Edward B. Haden of Esterbrook pointed out: "This is a typical case where anyone with a little knowledge of the fundamental techniques so easily obtained, can make substantial savings in dollars and accomplish major improvements in quality and uniformity of the products."

Two factors probably present the chief obstacles to overcoming the inertia in any plant considering the use of statistical quality control. They are the need for exact records and for inducing the enthusiastic support and understanding of the men or women involved in making the records. In reality, they are not big problems and once the program is under way its progess is virtually automatic.

Basic Records

Two basic records are used in most applications. They are the Work Sheet and the Quality Control Chart.

The work sheet is used to record the readings, measurements, or observations of the sample lots inspected. A typical work sheet (p. 82) provides for keeping a record of 20 samplings of five pieces at one-hour intervals. The five readings in each sample are added and from this total or sum the average is figured and recorded. To get the range in variation, the lowest reading of each sample group is subtracted from the highest reading.

Range and average figures are in turn averaged to obtain the Average Range and Grand Average. These figures are important as the basis for calculating the upper and lower control limits for the Control Chart (example on p. 83) by which

THE AUTHOR

Robert K. Mueller has been general manager of the Monsanto Chemical Co.'s Plastics Div. at Springfield, Mass., since August 19, 1952.

Before coming to Monsanto, Mueller was employed by the Sinclair Co. at its East Chicago refinery as a chemist. He came to Monsanto in 1935 and, working his way through several positions, became assistant production manager, and later production manager. He was appointed assistant general manager in October, 1950.

He is a member of the executive committee and board of directors of Shawinigan Resins Corp. A well-known speaker in professional circles, he is the author of "Effective Management Through Probability Controls" published by Funk & Wagnalls.

Sections taken from Work Sheet and Control Chart used to record production of a molded plastics part under Statistical Quality Control. For complete Work Sheet and Control Chart, see pp. 82-83

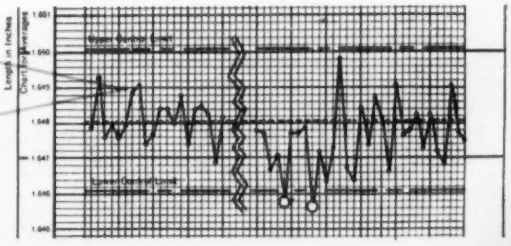
WORK SHEET

SUM	2396	2466	2381	2419	2381	2399
Average $\bar{X}$	479	493	476	480	476	480
Range R	46	25	52	37	22	35

7	8	9	10	11	12	13
4724	489	477	466	495	484	478
5054	487	479	480	4649	4614	4764
498	466	478	4764	479	481	477
485	509	478	4598	5108	4809	4944
488	504	4604	481	493	514	476
2444	2455	2389	2582	2421	2430	2401
489	491	478	476	484	486	480
51	41	18	37	46	53	18

6	480	33
7	489	51
8	491	41
9	474	18
10	476	37
11	484	46
12	494	55
13	480	18
14	488	68
15	494	54
16	484	52
17	485	29
18	483	19
19	469	20
20	482	62
Σ	9627	Σ 711

CONTROL CHART



Monsanto Chemical Company
PLASTICS DIVISION
PLANT LABORATORIES

MACHINE NO. RP-4 SHIFT All **WORK SHEET** PRODUCT NO. Base 2943
NOTES: all dimensions 1.6000 + for $\bar{X}$ and R Chart DIMENSION Length D
DATE Oct. 10 1952

SAMPLE GROUP NO.	1	2	3	4	5	6
→	504*	503	481	482	489*	469
SAMPLE READINGS OR MEASUREMENTS	458*	496	471	499*	479	489
	479	481*	455*	462*	478	462*
	478	504*	487*	475	468	495*
→	477	482	487	481	467*	484
SUM	2396	2466	2381	2399	2581	2399
Average = $\bar{X}$	479	493	476	480	476	480
Range = R	46	23	32	37	22	33

	AVERAGES	RANGES
1	479	46
2	493	23
3	476	32
4	480	37
5	476	22
6	480	33
7	489	31
8	491	41
9	474	18
10	476	37
11	484	46
12	484	53
13	480.	18
14	488	58
15	474	54
16	484	32
17	485	29
18	483	19
19	469	20
20	482	62
	Σ 9627	Σ 711
	$\bar{\bar{X}}$ 481.4	$\bar{R}$ 35.6

SAMPLE GROUP NO.	7	8	9	10	11	12	13
	472*	489	477	466	493	484	478
	503*	487	478*	480	464*	461*	476*
	498	466	478	496*	479	481	477
	483	509	478	459*	510*	480	494*
	488	506	460*	481	475	514	476
	2444	2455	2371	2382	2421	2420	2401
	489	491	474	476	484	484	480
	31	41	18	37	46	53	18

SAMPLE GROUP NO.	14	15	16	17	18	19	20
	486	468	470*	490	478	469	451*
	487	449*	491	484	485	476	467
	460*	470	475	487	477*	457*	495
	490	489	480	468*	480	466	484
	518*	493*	502*	497*	496*	477*	513*
	2441	2369	2418	2426	2416	2345	2410
	488	474	484	485	483	469	482
	58	54	32	29	19	20	62

NOTES: $\bar{X}$ = Average of averages
$\bar{R}$ = Average of ranges
Σ = Totals

*Starred measurements are highest and lowest within subgroups, used to calculate the range.

After control limits are established, only $\bar{X}$ and R need to be calculated.

FOR AVERAGES CHART

Upper limit = $\bar{\bar{X}} + A_2\bar{R}$ = 501.9
Central line = $\bar{\bar{X}}$ = 481.4
Lower limit = $\bar{\bar{X}} - A_2\bar{R}$ = 460.9

FOR RANGES CHART

Upper limit = $D_4\bar{R}$ = 75.3
Central line = $\bar{R}$ = 35.6
Lower limit = $D_3\bar{R}$ = 0

See Table I for values A_2, D_3, and D_4.

Completed Work Sheet on a molded plastics part. Dimensions of sample pieces, taken five at a time at prescribed time intervals are recorded, in this case, in variations of ten-thousandths of an inch. "Averages" and "Ranges" are transferred to columns so headed and are then summarized as average values

the production department traces the quality pattern of its operations.

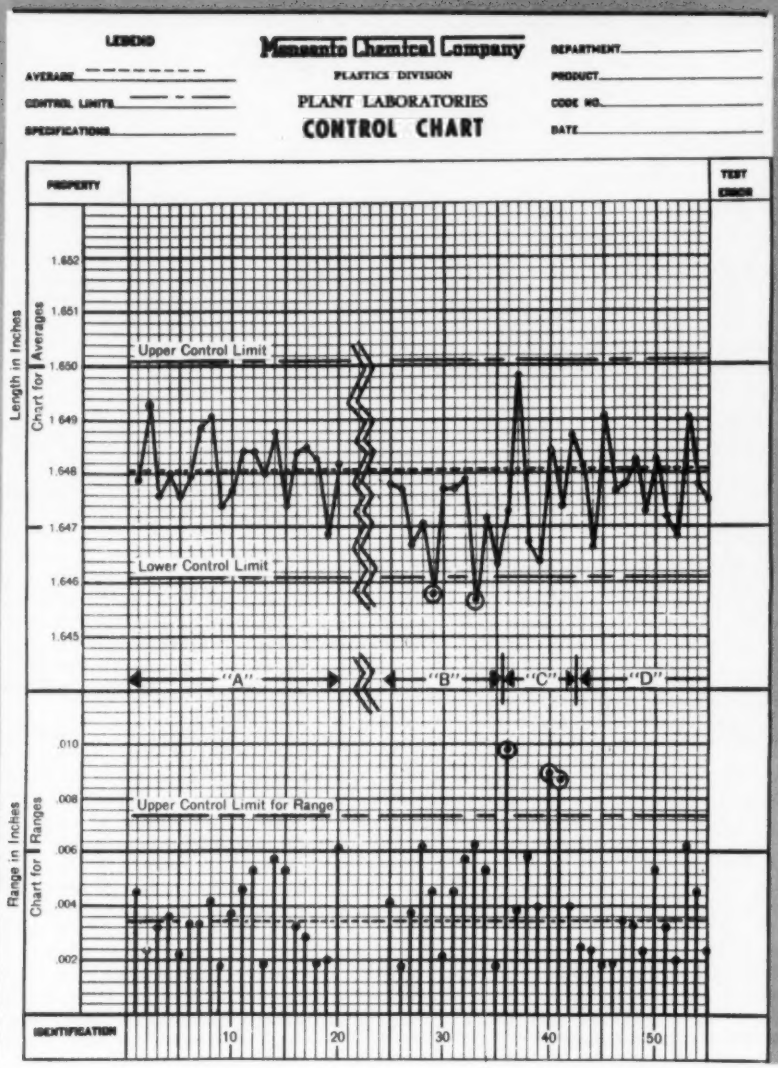
This Control Chart is essentially a map outlining quickly the progress and direction of quality. Usually the chart is divided into two sections, one for averages, the other for ranges.

Both the averages and ranges have upper and lower control limits —the highest and lowest figures taken from the work sheet for those particular categories. The upper and lower control limits perform the obvious function of warning the manufacturer of excessive variation in the quality pattern. An increase in average range, indicated by marks above the upper control limit, mean only one thing . . . production troubles.

In general, the averages section of the Control Chart tells the story of the collective trend away from or toward the norm. The ranges section reflects the performance of the individual item as opposed to the group.

The "out of control" points indicated by area "B" of the Control Chart (p. 83) indicate that the quality trend for individual pieces is seriously unstable, a fairly common development after a machine adjustment has been made. This could mean problems in the feed to a multiple cavity mold due to non-uniform raw materials. Or—and this is more likely—it could be the result of mechanical factors that had not yet come into balance.

Forecasting potential trouble is one of the most valuable features of statistical quality control. A consistent downward trend of the Con-



Control Chart is plotted from statistics recorded on Work Sheet. In this form, the statistics are transformed into an easily read "picture" of production. Upper and lower control limits are established from the formulas shown on the Work Sheet and the constants and formulas in Table I, p. 81. The center line is the grand average from the Work Sheet on opposite page

trol Chart pattern, for example, gives adequate warning that a correction must be made in the production operation. The Control Chart helps in pinpointing the trouble by recording the exact job lot involved and the time the deviation occurred.

Setting up statistical quality control in the plastics plant is not difficult. However, it should grow, like Topsy, from one machine to the next, from one department to the next. This method has demonstrated best results as opposed to a blanket installation for the entire plant at one time.

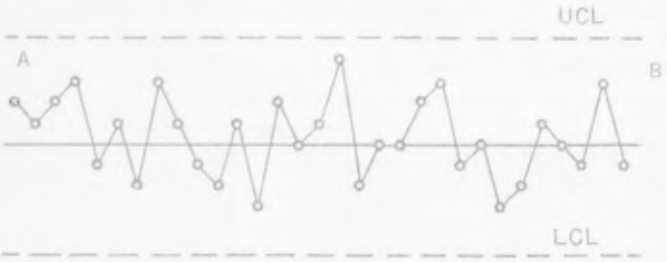
In its initial stages, statistical control methods should parallel present inspection methods. As a general rule, only one or two dimensions or characteristics of the product are charted. Critical dimensions, those with closest tolerances, those normally most difficult to control, or those that have the maximum effect on future assembly operations, usually are selected.

Frequently, the inspecting staff can be reduced after statistical quality control methods are established. A capable inspection crew should be able to adapt itself to the new procedure smoothly, and soon show a reduction in inspection time and problems.

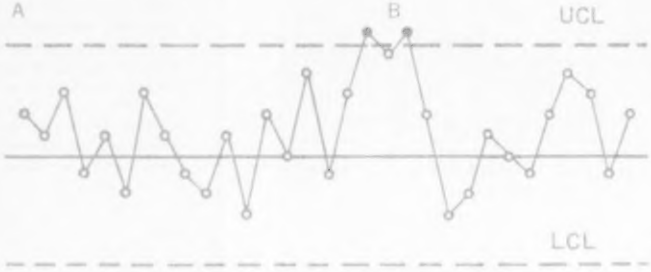
Training the personnel involved —operators, inspectors and supervisors—should be complete, but here again, the course should be smooth. No extensive education, knowledge of higher mathematics, or special equipment is necessary.

Another advantage in adopting statistical control methods is its ef-

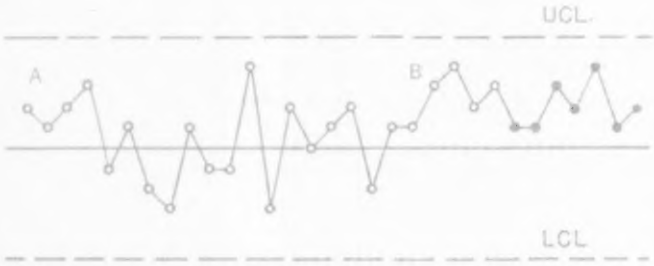
TYPICAL CONTROL CHART INTERPRETATIONS



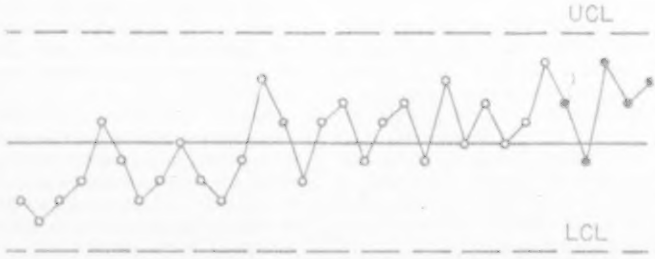
Control Chart pattern for a process in good control. Variables controlled prior to point A were adequately controlled through B and quality variation is completely random



Control Chart pattern of a process out of control at point B



Control Chart pattern showing that, near point B, some process variable changed and process after B was definitely operating at a new level. This level may be desirable or undesirable; in any case, its cause should be found and corrected or adopted



Control Chart pattern showing a trend of check points diagonal to average. The process is not producing at a stable level of quality and, again, the cause should be found

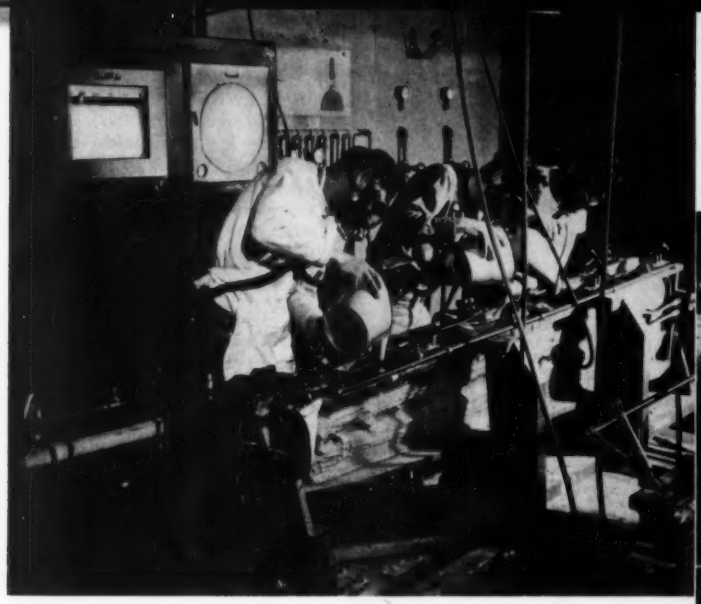
fectiveness as contrasted to 100% inspection in nearly every case. An independent research firm added a known number of "defectives" to a perfect lot of items and then subjected them all to a 100% inspection. Only 68% of the defective pieces were caught in the first inspection. Three additional inspections were necessary to weed out 98% of the known defects. Thus, the 100% inspection system does not guarantee quality perfection. In fact, the "risk error" may be driven underground and, hidden and uncalculated, become uncontrollable.

Durability Demonstrated

Consolidated Molded Products Corp. has demonstrated the durability of the statistical quality control system applied to each new mold. Once statistical limits are established they become the guide for all future use of the mold, whether it is in service continuously or, as is often the case, periodically for one or two days a month. With work sheets and control charts to identify start-up troubles immediately, start-up scrap has been reduced materially.

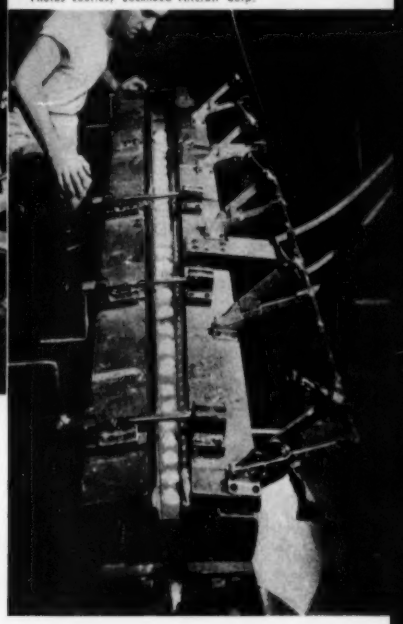
Consolidated found that multiple-cavity molds presented more complicated problems. However, statistical analyses provided a method to separate the sources of difficulty and to define the cause or causes of excessive variability. By breaking down inspection data, Consolidated was able to select the mold dimensions required for the desired product, identify optimum molding conditions for temperature and pressure, assign the variability due to using several machines and operators, and set the bounds within which product quality should be maintained. Any deviation from these limits is a green light to look for trouble and correct it, often before defective material has been produced.

Disregarding the question of savings in time, labor, or money, E. W. Birney, Consolidated vice president, has another argument supporting this new management tool. "We could not satisfactorily meet today's quality requirements," he said recently, "without the aid of statistical quality control. In fact, it would have been technically impossible to produce certain articles without recourse to statistical methods."



Isocyanate-based Lockfoam is poured into aileron section by gas-masked operators. Foaming starts after 1½ min. of premixing; foam bonds to inside face as it cures

Photos courtesy Lockheed Aircraft Corp.



As foaming nears completion, excess oozes out through holes in the web

3 New Foams

Two isocyanates and a urea material are rapidly expanding into industrial and consumer applications

EXPANSION—the characteristic that distinguishes foamed plastics—is a descriptive term that can apply equally as well to the amazing progress of these materials. Prompted by continuing research that has developed new uses and new characteristics for foamed plastics, the number of marketable products are steadily increasing.

Three foams recently introduced are indicative of the versatility of the materials and of the progress they have begun to make in a number of industrial and consumer applications. The new foams are Armofoam, a product of Armour and Co., Chicago, Ill.; Lockfoam, a product of Lockheed Aircraft Corp., Burbank, Calif.; and Colfoam, a product of Colton Chemical Co., Cleveland, Ohio.

Both Armofoam and Lockfoam are isocyanate-based; Colfoam is urea-formaldehyde-based.

The two isocyanate-based foams—Armofoam and Lockfoam—exhibit many similar characteristics and have many similar applications.

Isocyanate Bases

Both have pronounced structural strength, marked stability to heat, insolubility in water and most petroleum products, and good insulation properties. Expanded plastics utilizing isocyanates show good adhesion to wood, primed metal, fibrous glass laminates, and fabrics when they are foamed into contact with such surfaces. The firm bond that is formed can eliminate many difficult cementing operations in a given assembly.

These two foams, since they are prepared as pourable liquids, are especially adapted to filling cavities—regular or irregular in shape—where light weight, high strength, and vibration dampening are desirable factors. These foams are also finding eager markets as the core material in sandwich construction, in potting electrical circuits, and for flotation gear.

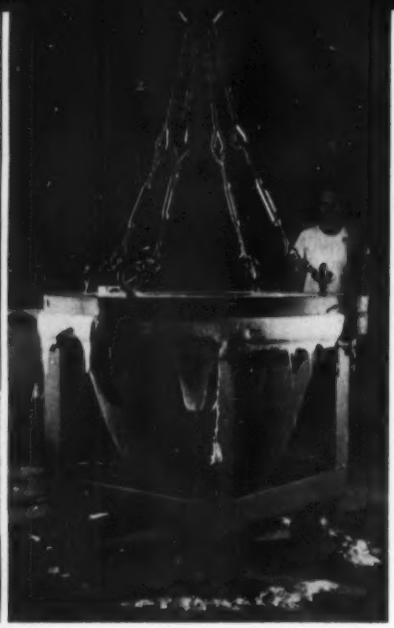
Armofoam and Lockfoam are cellular, self-cured plastics expanded by carbon dioxide gas formed by the chemical reaction between the polyisocyanates and the resinous polymers in the formulation. As the pourable liquid turns into a dough-like mass and increases in size, the carbon dioxide gas which is evolved forms the cells which give the material its foamed characteristics. The polyisocyanates are capable of copolymerizing with the resinous matrix, causing it to set or cure after the expanding process has been concluded.

Preparation

The original liquid mixture can be readily poured into cavities where it will expand and bond to the inside surface. It can also be sucked by vacuum into cavities through openings too small for normal pouring.

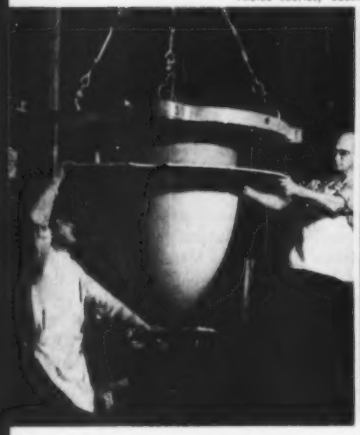
The wide range of densities developed for both of these isocyanate

Lockfoam is poured into fibrous-glass lined die to form aircraft radome



After foaming, the plastic remains between the dies for an 8-hr. cure—6 hr. at 200° F. and 2 hr. cool

Photos courtesy Lockheed Aircraft Corp.



Upper punch die, with hardened radome adhering to it, is then raised

Foamed radome is carefully inspected before being trimmed, painted, and readied for installation

foams makes possible a greater selectivity for a given application.

To produce a Lockfoam to meet certain physical and chemical specifications, it is necessary to maintain precise adjustment of all the reaction factors involved. This includes control of the ratio of alcohol to acid groups, viscosity, water content, chemical character of the resin components, and the final resin acid number. Polyester resins having acid numbers ranging from 10 to 100 provide a basis for wide variance in physical properties. Modification of the isocyanate itself also facilitates control of the reaction process.

Several types of cellular forms are available in the Lockfoam series, from inelastic materials of high compressive strength to flexible, elastomeric spongy products. The density range runs from 1½ to 35 lb. per cu. foot. Cellular structure can be produced with a spherical cavity variation of from 0.01 to 0.30 inch.

There are two flexible types of Lockfoam. One is a strictly thermoplastic material which will melt and flow at an elevated temperature. The other is a plasticized version of the thermosetting rigid type. Like rubber, both flexible types can be readily distorted under light pressure, but they do not have the rapid recovery rate characteristic of rubber.

The hard and rigid type of Lockfoam has good strength properties at elevated temperatures and several versions will withstand appreciable compression at temperatures up to 350° F. Sheets of the rigid material may be sawed or carved to any desired size.

Armofoam

It is also possible to vary and control the density of Armofoam within reasonably narrow limits by modifying the composition of the two-part liquid formulation. The core density of Armofoam ranges from 3 to somewhat over 20 lb. per cu. foot. Over-all density, which includes entire casting and skin, is usually from 20 to 100% higher depending upon the shape of the cavity. On small castings, the over-all density runs from about 5 to 50 lb. per cu. foot. Cellular structure of Armofoam is similar to that of Lockfoam. Forms vary from a somewhat friable version to a firm, porous, and infusible solid.

Applications

Evidence of the tremendous potentialities of the two isocyanate-based foamed plastics is found in the uses to which they have already been successfully applied and for which they are being developed.

Aircraft Radomes—the amazing performance at phenomenal speeds of the F-94 Starfire jet interceptor is aided to a great extent by the use of Lockfoam, particularly as the core for radomes. In the production of these radomes, the foam is allowed to expand between two preformed laminated Fiberglas shells. The shells are positioned in metal or plastic dies during the expansion process to hold the piece to exact dimensional tolerances. Advantages of the cured radomes include transparency to radar frequencies; excellent insulation against heat, cold, vibration, and electricity, and the ability to with-

stand the flight test loads put on jet aircraft.

Aircraft Structural Parts—one of the largest potential aircraft uses of both Lockfoam and Armofoam is as a strong, lightweight core material for ailerons, trim tabs, wing sections, rudder tabs, and leading edge sections.

Under intense and prolonged vibration, the foam coring will neither shatter nor separate from the metal surface. It is tough and resilient enough to resist high impact or shock. Tests made on one selected density range of Lockfoam showed that .50 caliber machine gun bullets would penetrate but would not shatter the foamed plastic. Another development by Lockheed is a foam-filled aileron which provides a lighter part capable of meeting load requirements and which greatly reduces the number of parts in the assembly.

The isocyanate-based foams are equally as effective in lessening or damping vibration interference in aircraft structures.

Lockfoam has already been applied to fuselage sections, bulkheads, door panels, and other structures capable of resonant vibration. Brush application, prefabricated slabs, or the pour-in-place technique may be used. One probable future development along this line is the use of the foams in earmuffs as protection against noise and cold.

Electrical—In the potting of electronic equipment, Lockfoam provides a simple and effective method of locking the components in an immovable position. The equipment can be built in boxes and the Lockfoam poured in to hold the parts tightly in place to stop vibration and to give excellent electrical insulation. Armofoam also has marked bonding power and insulation properties which make it particularly well suited for potting.

Packaging—The ability of Lockfoam to deform under load readily without the quick recovery of rubber permits the material to absorb heavy loads without rapidly transmitting the energy. This characteristic is of particular advantage in the packaging of delicate equipment. Radios and TV sets might be dipped in liquid Lockfoam before shipment and the protective covering stripped off on arrival.

Flotation—The low density of both of the isocyanate-based foams also makes them useful in floats, buoys, life rafts, and life belts. The intermittent use of such articles does not require that the foam be protected other than with a suitable paint or lacquer finish. If it is to be exposed to continuous immersion, however, it should be enclosed in a thin envelope of metal or laminated fibrous glass.

Lightweight Armofoam is used as the strong core material to fill hollow wing sections

Courtesy Armour and Co.

Phenolic-based Lockfoams, similar to the isocyanate types, are also available. These foams are less expensive than the isocyanates and are used for building board in the construction industry. The board is lightweight, durable, unaffected by dampness, fire resistant, and an excellent sound-proofing and insulating material.

Colfoam

Colfoam duplicates many of the characteristic advantages of the isocyanate-based materials. It is, however, an inert thermosetting plastic composed of aerated urea formaldehyde, 99% air by volume. Its nominal density is 0.8 lb. per cu. foot.

Colfoam is available in three forms —block, slab, and shredded. The block forms are rigid and are supplied in a wide variety of sizes and shapes to fill regular cavities. The thin slabs can be reinforced on two sides with paper, cloth, or resin coatings to facilitate handling, speed up installation, and eliminate breakage problems. Shredded Colfoam is obtained by shredding blocks to a special uniform particle size particularly suitable for blowing. Nominal density of the shredded form is 1.2 lb. per cu. foot.

Colfoam is made by combining soluble resins into a liquid which is frothed to produce a light, fluffy mass. This is gelled to capture the texture, then permanently set and dried to solidify the mass.

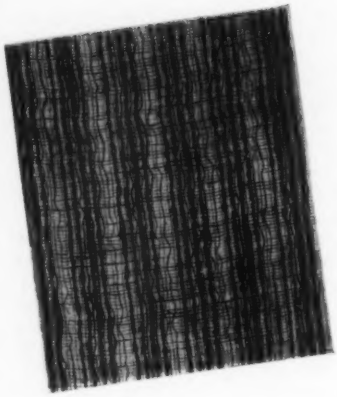
Outstanding property of Colfoam is its very low thermal conductivity, which suits it for a variety of practical applications in low temperature insulation, including household and commercial refrigeration units, frozen food shipping containers, and permanently installed building refrigeration units.

The material also possesses good moisture resistance, resistance to exposure to cold and heat, corrosion immunity, and excellent sound-proofing qualities. When used for flotation purposes, an uncoated block of Colfoam will float with 40% or more of its bulk above the surface even after total submersion for two hours.

The three forms in which Colfoam is available facilitate its handling in both irregular and regular shaped cavities. The shredded version is used to fill irregular shapes, since it is a lightweight material of small particles, ½-in. or less in diameter, and can easily be poured and packed or blown to the required density for maximum efficiency and insulation value.

Uniformly sized shredded Colfoam can be poured to fill irregular cavities

Courtesy Colton Chemical Co.



All photos courtesy Polyplastex United, Inc.

Screen, vertical blinds, and table tops are typical applications of rigid decorative laminate; seat cover is one use to which the flexible decorative laminate can be put

Beauty Sealed IN VINYL LAMINATES

VERSATILE decorating materials in fresh new designs are produced by locking unusual fabrics, unwoven fibers, grass stalks, leaves, or feathers between two vinyl sheets in a laminating process. The wide range of materials that can be incorporated in the laminates, coupled with the many variations possible in color, translucency, and thickness, provide a stimulating variety of decorative media for interior decorators, upholsterers, architects, and designers.

These new laminates are available from Polyplastex United, Inc., New York, N. Y., in two forms—Panlam, a rigid laminate, and Panflex, a recently introduced flexible laminate that incorporates the same design range and patterns as Panlam. Duplication of design in both forms now makes it possible to achieve new effects in decor harmony and coordination.

Panflex

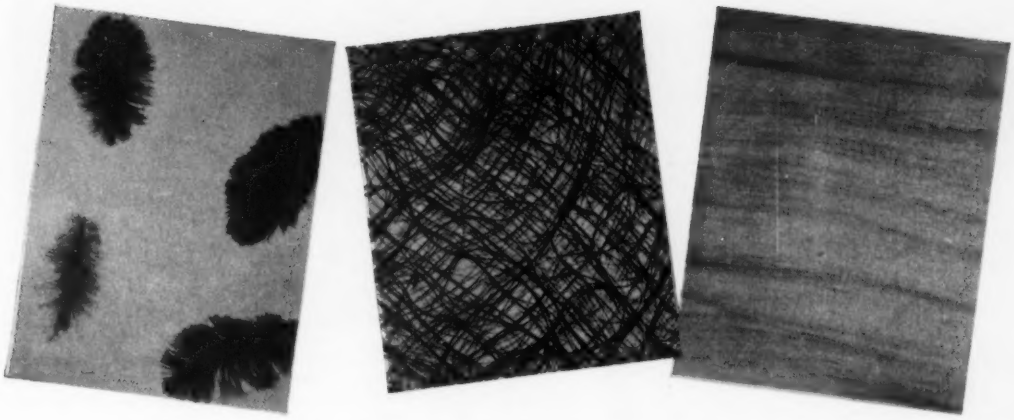
The Panflex sandwich consists of two layers of flexible Vinylite bonded together under heat and pressure. The specially treated—usually dehydrated—filler material in the middle of the sandwich is penetrated by the vinyl and thus locked in place. Among the many materials used for their decorative effect are pastel tinted leaves from Japan; ostrich feathers; straw colored hemp fibers; nubby burlap; and woven metallic thread. Either matte or gloss finish can be given to the surface of the laminate.

Panflex is produced in thicknesses ranging from 0.010 in. up to 0.250 in., and consequently can have almost any degree of flexibility required for a particular application. The material is equally as suited for upholstering chairs and settees as it is for wall covering, paneling, or surfacing of tables, desks and cabinets. Future applications are expected to include luggage, brief cases, book covers, handbags, and many similar products in which the durability of vinyl and the flexibility of the laminate are of major importance.

Panlam

The sandwich construction of Panlam is similar to that of Panflex except that the outer layers are rigid Vinylite sheets. Thicknesses range from 0.010 to 0.250 in. and again, a matte or gloss finish can be given to the surface.

Panlam is reported to have excellent dimensional stability, maintaining its shape even under exposure to water and at temperatures up to 140° F. It is stated that it will not warp and is unaffected by aging. Because of the thermoplastic properties of vinyl, Panlam can be readily vacuum formed in deep three-dimensional relief and has al-



Samples of new vinyl laminates, above and on opposite page, show some of the decorative materials being utilized

ready been used to produce a series of radically designed light bowls and translucent displays.

Other applications in which the unique qualities of the rigid laminate have been used to advantage include screens, wall coverings, lampshades, room dividers, vertical blinds, and table tops.

Decorative Possibilities

Duplication of patterns in both flexible and rigid laminates permits many attractive motifs. For purposes of decor coordination, chairs and settees can now be upholstered with designs duplicating those appearing in screens, wall coverings, or lampshades. At the same time, harmony can be effected by varying the colors used. By tinting or dyeing the filler material to desired shade, different color schemes can be obtained. Since the top layer of the laminate is usually clear, the color of the sealed-in decorative material will show through against the color background of the opaque or translucent bottom layer.

Practical Advantages

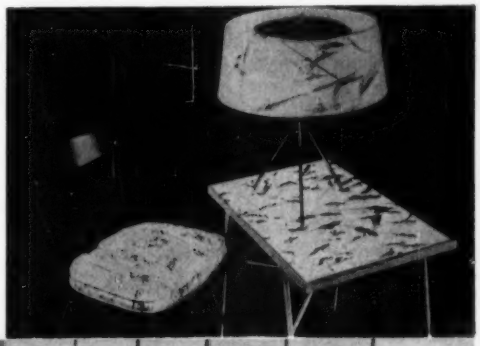
Both laminates possess the many serviceable qualities of vinyl. They are durable and will resist tearing, fading, warping, shrinking, abrasion, and scuffing. Both are also unaffected by moisture, mildew, mold, grease, and most chemicals. Simple washing will keep them clean.

Important to the user of these laminated materials is the fact that they are adaptable to standard finishing techniques. They are easy to fabricate in flexible, rigid, or semi-rigid form and can be cut, sewed, stapled, embossed, electronically welded, or cemented. The laminates can be bonded to any flat curved surface with conventional solvent or pressure-sensitive adhesives.

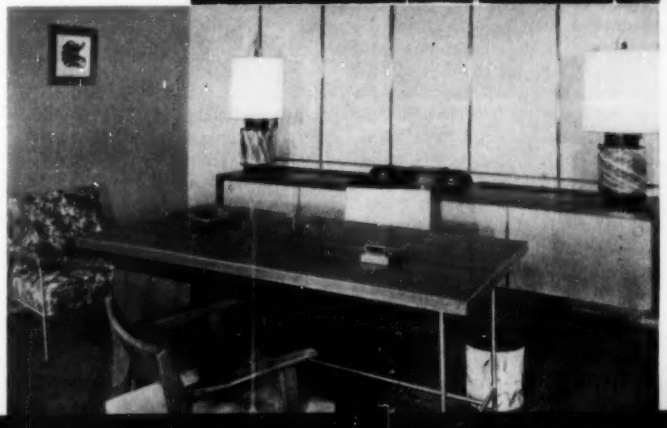
Additional decorative effects with both Panlam and Panflex can be obtained by surface printing, painting, flocking, silk screening, or spraying. Distinctive surface textures are also possible by laminating a clear top layer of thin vinyl over an open weave fabric. The vinyl will penetrate the open space between the threads, reproducing the rough surface feel of the fabric to a certain extent.

Both laminates are available in standard sheet sizes of 48 by 72 in. or 38 by 62 inches.

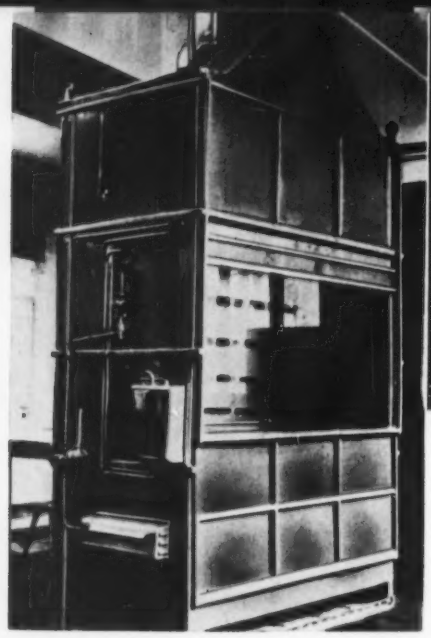
Since motifs can be repeated in both the flexible and rigid material, a harmony of decor seldom obtainable with other media can be effected



Wall paneling, table tops, upholstery fabrics, and lamp shades and bases are among the many uses to which the new laminates can be put



New British vinyl copolymer sheet is used in printing. At top right is vinyl matrix; top center, matrix sprayed and backed with metal; top right, electrotype; lower left, printing form; right, printed sheet



Entire electroplating cabinet at left is fabricated of copolymer sheet except for glass panels. The plastics material successfully resists the acid fumes, which are neutralized by a chemical and washing process

BRITISH THERMOPLASTIC SHEET

Vinyl copolymer material is easily formed by drawing or compression molding. Tooling costs are low; end products are strong and dimensionally stable

by A. K. Astbury*

BASED on a vinyl chloride-vinylidene copolymer, a new thermoplastic sheet is being used increasingly in Britain for applications where there is need for large, deep-drawn moldings which are both strong and dimensionally stable.

Many of the present uses of this material, known as Cobex, are industrial—to help in the manufacture of other products—but deep-drawn Cobex sheet is also being used in a number of end-products such as aircraft accessories, lighting troughs, deep-freeze lids, tanks, and trays. The sheet neither kinks nor thins out in molding and is particularly resistant to rough usage. But its outstanding characteristics are that it can be fabricated in short or long runs on mass production lines without large capital expenditure and that it is dimensionally stable even in large, deep moldings.

Wooden molds which any carpenter or pattern-maker can produce are the only tools needed, so that fabricating costs amount to little more than workers' time. An injection molded job which, in styrene, for example, might have to be made in batches of up to 25,000 to cover capital costs, could be made profitably by draw-molding Cobex because the mold needed and the time of the man who made the mold would probably cost under $15.

Calendered Sheet

Cobex is made by BX Plastics Ltd., Higham Station Avenue, Chingford, London E. 4, England, a subsidiary of British Xylonite Co., Ltd. The resin is produced by an associated company, British Geon Ltd., which is jointly owned by Distillers Co., Ltd. and B. F. Goodrich Co. The resin is compounded with coloring matter and then calendered into continuous sheet; thick sheet is made up by pressing a number of layers together.

Finished Cobex sheet is produced in some 25 colors and with glazed or matte surface. The ⅛-in. sheet sells at about 90¢ a square foot, with other thicknesses in proportion.

BX Plastics Ltd. had been interested in vinyl sheets ever since the last few months of the war. By the end of 1949 it was producing one ton of white Cobex sheet a month for

* Surrey, England.

deep-drawn refrigerator door linings. Cobex has also been used for slide rules since 1949, tests having shown that after 14 days at 50° C. and 100% relative humidity dimensional changes in the material are less than 0.1 percent.

Aircraft Uses

Today Cobex is being used by individual aircraft constructors who are doing their own molding—the de Havilland Aircraft Co., Ltd., for instance, is molding Cobex sheet for use in Comet jet airliners. The material is also used by British Overseas Airways Corp. in a number of its aircraft for crew space lining, lining of toilet compartments, toilet seats, toilet handbasins, and window frames; for these and other aircraft uses the United Kingdom Ministry of Supply has set up government specification DTD 900/4242 for Cobex.

Wood Grains

For over a year Cobex has been used for deep-freeze lids; it is used, transparent or opaque, for machine guards, largely in the boot and shoe industry; several thousand Cobex crash helmets have been made for post office telegram boys to wear while driving their motorcycles; lighting fixtures, trays, and tanks are being made out of this new material. Latest development is the production of mahogany-colored Cobex with wood graining.

The strength of these deep-drawn products is surprising. The writer jumped with all his weight on a Cobex tray 7 in. square by 3 in. deep with not the slightest effect; holding it by one corner, he tried to stave in the bottom by smashing it on the projecting corner of a steel chair, again to no effect.

Stretch Stability

As an example of stability, a tank with an outlet neck something less than one inch in length may be mentioned. The whole tank, neck included, is deep-drawn, with no evidence of thinning down. It is indeed characteristic of this new thermoplastic sheet that, in the molded article, thickness at the corners, where considerable stretch takes place, is no less than in the center of a deep-drawn panel where stretch might be assumed to be negligible.

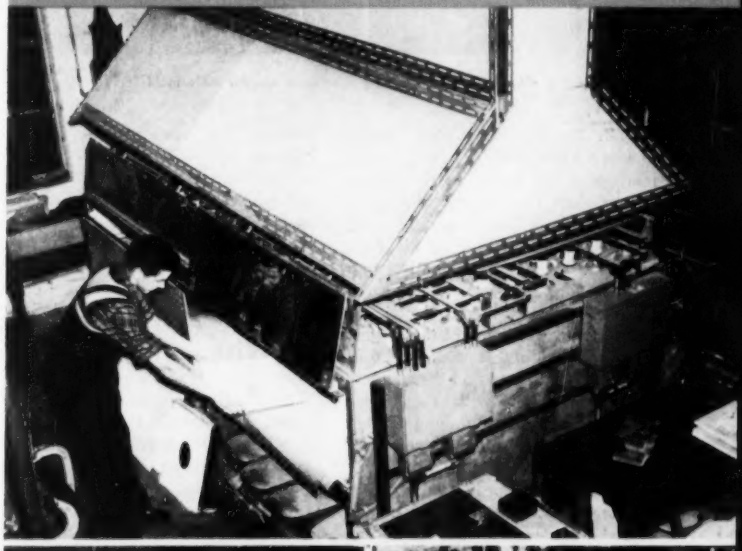
There are two main ways in which Cobex may be deep-drawn: pneumatically, with or without a mold; or by stamping out between registering male and female molds.

Molding Methods

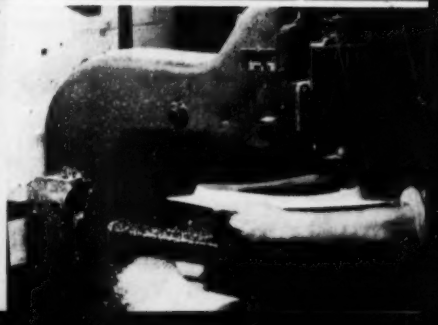
It has been found that simple vacuum sucking is suitable for a number of processes—molding of trays, for example. But there are many occasions when it has been found unnecessary, and even simpler methods of molding have been adopted. In the case of trays it has been found possible to obtain perfect results by simply forcing a male tool into a female mold. Each molder has his own preference, and it is not unusual to find different molders producing exactly the same article by entirely different methods. Miners' safety helmets, for example, are being produced by both vacuum sucking into a female mold and by forcing downwards by a male mold.

There are no standard machines in

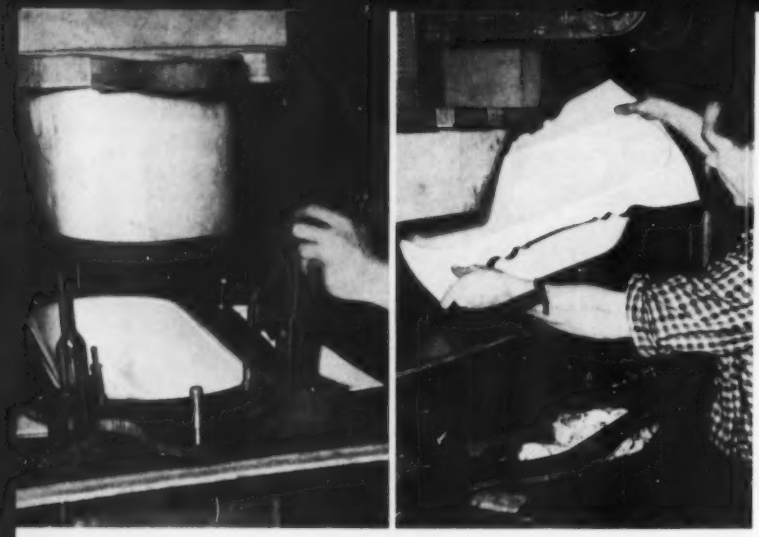
SHEET FORMING A TELEVISION MASK



Photos courtesy Thermo-Plastics Ltd., Dunstable, Eng.



Top: Infra-red oven for heating vinyl copolymer sheet preparatory to forming. Above: Sheet, flexible because it has been heated, is placed over female mask mold. Hole in center is to allow free stretching. Above, right: removing formed sheet from press. Right: Routing mask to required aperture.



Vacuum forming vinyl copolymer sheet by snap-back against male mold

Britain for forming Cobex. Many molders have made, or had made, machines to their specifications. Platen sizes, like the machines, are variable, the effective range being from 12 by 12 in. to 5 by 2½ feet. Larger platens are being designed but are not yet in use.

Cobex is heated in gas, electric, or infra-red ovens. Some of the largest ovens, 8 ft. high, 6 ft. wide, and 6 ft. deep are gas heated and thermostatically controlled, with the sheets hung on bars running along the top of the ovens. Forming temperatures range from 100 to 160° C.

Infra-red heating is used by some of the largest molders when a long run is contemplated. Lamps can then be banked and left undisturbed for the duration of the run. Some automatic devices for carrying sheets direct from oven to press are in operation.

The spacing of infra-red lamps in an oven requires some care, for overheating will lead to decomposition; on the other hand, it has often been found that deeper draws can be attempted after correct infra-red heating than after gas or electric heating.

Spherical shapes, where accurate reproduction is unnecessary, may be blown like glass. Where a particular shape is required, the sheet may be forced against a female mold by compressed air or vacuum; or, once distended by lowering the outer air pressure, may be allowed to snap back on to the male mold when pressure returns to normal.

Molds for deep-drawing may be made of metal (but not brass) for precision work or long production runs. In general, wood, laminated phenolic blocks, plywood, cement, or plaster molds suffice.

Cobex neither burns nor smolders when a flame is played on it; is unaffected by most chemical reagents and is a good electrical insulator. Caustic soda, caustic potash, and sodium carbonate in concentration will attack Cobex very slighty at room temperature; dilute solutions have no effect. It is subject to slight attack from ether and aviation spirit; it softens, but does not dissolve, in benzene, xylene, and chloroform, but is soluble in acetone, methyl ethyl ketone, cyclohexanone, and tetrahydrofuran. Concentrated hydrochloric, nitric, and sulfuric acids do not affect it. It is soluble and slowly disintegrates in ethyl acetate, softens and is slightly soluble in dioxan; but it resists entirely a wide range of acids, oxidizing agents, aqueous salt solutions, and most lubricating oils and greases.

Properties

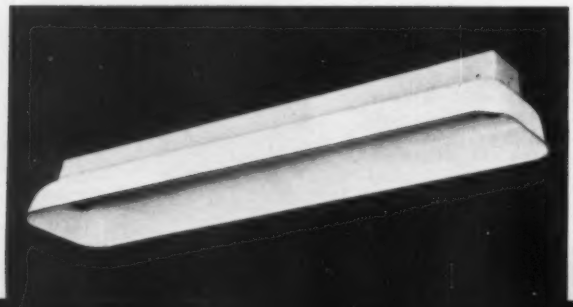
Although comprehensive parallel tests on Cobex and comparable plastics such as styrene, styrene-butadiene-acrylonitrile copolymers, other vinyls, polymethyl methacrylate, and cellulosics have not yet been carried out, the maker of Cobex claims that its product resists at least as wide a range of chemical reagents as any other vacuum formable sheet material. Further, it is claimed that Cobex can safely be used with corrosive chemicals—in the pickling and electroplating industries, for example—where other vacuum formable sheet materials may fail to perform as well.

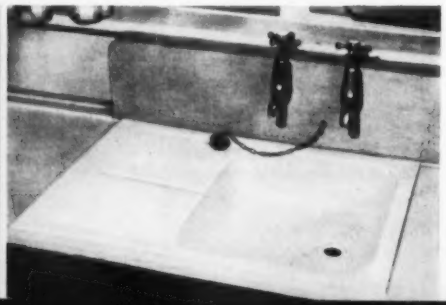
Impact strength as normally measured is not so high as in some of the butadiene type copolymers or the cellulose plastics. Cobex is still, however, an extremely tough material. Its dimensional stability is approximately equivalent to that of the vinyl chloride-vinyl acetate copolymers which are among the most stable of the vacuum formable sheet materials. It is, however, denser than these materials, which means that it is not quite so economical in use.

Cobex is supplied in sheets varying in thickness from 0.01 to 1.0 in.; rolls can be continuously embossed in any desired pattern.

Cobex can in general be machined in the same manner as wood, although care must be taken to avoid friction heat. It can also be printed by standard methods although because of its solvent inertness special inks may have to be used.

Three-ft. lighting trough and, right, sink for trailer. Both are formed of new British thermoplastic sheet





Reinforced Plastics Conference

Eighth annual gathering finds equal emphasis placed on sales, management, and technical problems. New resins and reinforcements were introduced

IN scope of information presented and interest in new developments, at both technical and application levels, the Eighth Annual Technical and Management Conference of the Reinforced Plastics Division of S.P.I., held at Washington, D. C., February 18, 19, and 20, reflected the fact that this division of the plastics industry has expanded by 50% in every recent year. Total registration was 1416, with 437 companies represented, of which 193 companies were S.P.I. members.

For the first time in the history of the division, as much emphasis was placed on sales and management problems in the industry as on technical and engineering problems.

The program for the conference was published on page 83 of the February issue of MODERN PLASTICS, and preprints of the papers presented were made available to all who attended. Further reprints of the sessions will be produced by S.P.I. and will include the question and answer parts of the program.

The whole trend of the industry as exposed by material presented at the conference is obviously toward greater accuracy and speed of production, improved finish, and the broadening of markets that will come from these factors. Much more discussion in the sessions and in the lobbies centered on press molding in high-accuracy metal molds than has been noticed in previous conferences. There was little talk of low pressure per se and of low-cost tooling. Obviously, the reinforced plastics industry is headed toward mass production.

As usual, a great number of new resins were announced, which, in a field where at least 18 material makers are competing for an as yet fairly small volume of business, might be considered a paradox. The fact is, however, that some of the new resins will supersede other materials which are already obsolete. There does not appear to be a trend toward huge expansion of resin varieties but there is an apparent very general demand for more versatile resins.

In general, these specialized new polyester resins were designed for greater heat resistance and light resistance—the former being important in the electrical and similar fields and the latter being important to the glazing field, the boat and automotive markets, the new tank market, and other outlets still to be opened.

Parallel to presentation of two new promoters was the announcement of an unusual inhibitor intended to retard curing of the resin in hot metal molds long enough to allow proper flow and in hand layups to permit the operator a longer time on the layup job.

One of the most spectacular announcements concerned a thixotropic resin with much less shrink on molding than previous materials and designed not to flow unless pressure is applied, the flow being independent of temperature.

For Matched Metal Molding

Several new polyesters are designed especially for matched metal molding and several others are created for the purpose of pre-impregnating glass fabric or loading roving to be chopped and made into premixed materials.

The epoxies came in for a good share of attention with a general trend indicated toward simplified resin structures for use with a variety of catalytic systems. And graduating into the "big time" were the low-pressure phenolic resins for use with glass reinforcements.

New reinforcements were widely discussed. Two new glass fabrics woven in such a way that they would provide a "stretch" effect in drawing, two new mats, and a line of super-thick glass felts were announced. Standardized pre-impregnated materials and a broader range of pre-mix formulations were presented.

The customary military development and procurement session was well attended and a considerable trend toward standardized specifications of material for military use was indicated. This trend appears likely to have its effect on the civilian market.

Of all the committee reports offered at the conference, the report of the Standards Committee was most encouraging. Cooperation between the Reinforced Plastics Division of S.P.I. and the National Electrical Manufacturers Association in the matter of standards for glass polyester flat sheet appears likely to result in early establishment of the first group of standards in the field. The committee on corrugated sheet standards is also making rapid progress—progress which will be important to future markets for these materials. Further progress is reported in the establishment of a standards subcommittee on housings and appliances.

A unique feature of this year's conference was a panel luncheon session at which six case histories covered parts for an electronic accounting machine, a line of mass-produced quality molded chairs, components for high-capacity electrical equipment, a molded refrigerator liner, a line of reinforced plastics luggage, and the first reinforced plastics sports car body to be scheduled for mass production.

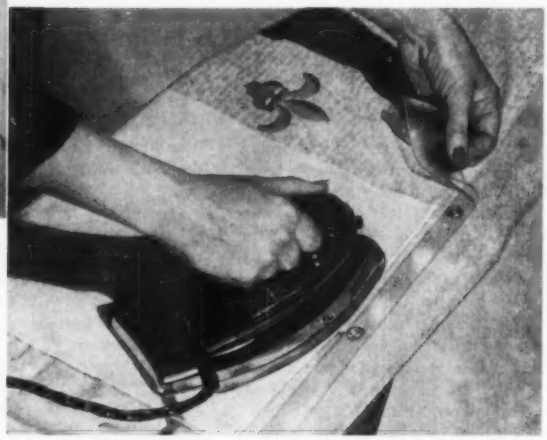
The exhibit hall this year offered spectacular proof of the growth of the industry and pointed up probable future growth. Items already in mass production were displayed, with bath tubs, boats, furniture, tanks, carnival equipment, housings, and industrial equipment dominating the scene.

Extra-session interviews brought out information on many new projects not exhibited. These included reinforced plastics gutters and downspouts, items of farm equipment, new aircraft applications, more sports car bodies, a garage door, and several new furniture items.

Make-Your-Own Shower Curtains

Fabrication made easy by new tapes coated with adhesive activated by light application of heat

Hanging shower curtain that was made at home in less than an hour, using vinyl yard goods and "iron-on" vinyl tape



Photos courtesy U. S. Rubber Co.

Heading tape for home made shower curtains comes in 72-in. lengths, complete with metal eyelets, ready to be ironed in place with control set at "cool"

TWO vinyl tapes, developed by John Dritz and Sons Co., New York, N. Y., offer a practical means for the housewife to transform vinyl film yard goods into attractive shower curtains.

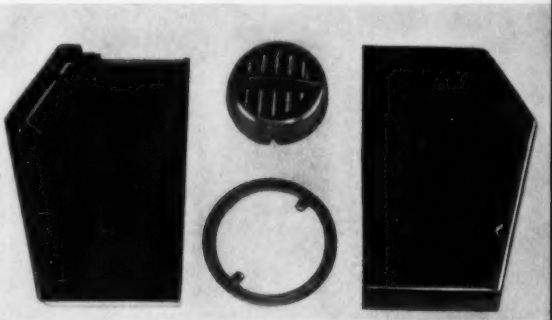
Both of the tapes—one of which is used for seaming, the other as a reinforcing heading for the curtain top—are made from Marvinol vinyl, supplied by Naugatuck Chemical Div., U. S. Rubber Co. Each is coated with an adhesive vinyl that is activated by a light application of heat. When film and tapes are ironed together, a firm bond is produced between them.

The seaming tape, ¾ in. wide, doubles both as a seal for two separate widths of film and as a mending agent for most vinyl accessories. It is available in 120-in. lengths.

The heavier gage heading tape, 1½ in. wide, comes inset with metal eyelets for hanging the curtain. It is available in 72-in. lengths and, like the seaming tape, is transparent so as not to obscure the color and pattern of the film.

Home made shower curtain itself is fabricated by bonding two lengths of vinyl yard goods with a strip of vinyl tape, one side of which is coated with an adhesive

ROOM COOLERS



Plastics parts (right) of handsome air conditioning unit (above), manufactured by O. A. Sutton Corp., includes styrene side panels, with molded-in projections for assembly to the main unit; outlet nozzle; and nozzle ring. To control direction of air flow, rotating nozzle pivots back and forth on the ring

Every home located where summers are hot and humid represents a potential market for air conditioning. In new construction or existing homes where over-all air conditioning is economically impractical, the room air conditioner is the answer. Plastics are making these individual units lower in cost, more durable, more attractive in appearance...and more salable. The accompanying article gives the facts as they stand today and points to the potentialities.

PLASTICS served as "mid-wife" to the birth of the room air conditioner and continue to play an increasingly important role in the amazing expansion of this "sleeping giant" industry. The first room air conditioners appeared only a few years ago in offices and homes. They all used plastics to some extent. Today, they employ plastics in more varied ways and, because the "sleeping giant" is wakening and the market is expanding rapidly, in much greater volume.

Expanding Markets

The steady progress that followed the debut of room air conditioners was halted during the war and was held down in the immediate postwar years by the low-cost housing program. By 1949, however, it had again gained momentum and by 1952 had swept to record sales. Manufacturers, stimulated by the demand, threw their weight behind increased production and full-scale consumer merchandising.

Estimates place the probable sales of room air conditioners for 1953 at 590,000 units—and this is still only a tiny 2% of the potential market. By 1955, the annual sales figure should be one million units and, if present estimates are correct, the two million mark will in all probability be reached by 1957.

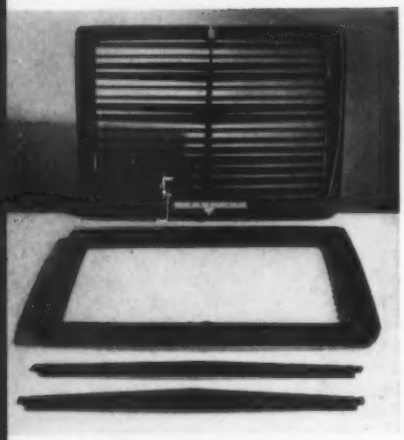
Within the framework of each company's individual plans for expansion, plastics have retained a well-entrenched position. Today, the units of large-scale manufacturers throughout the country have plastics parts ranging from knobs, nameplates, and frames to grilles, side panels, and entire housings. One user of plastics, the Fedders-Quigan Corp., Buffalo, N.Y., world's largest manufacturer of room air conditioners, has within the last two years invested over $200,000 in plastics molds alone. One producer of injection molded one-piece housings, General Electric Co., Chemical Div., Pittsfield, Mass., predicts that by mid-1955, most of the major manufacturers will have switched to all-plastics cabinets.

Included among the companies marketing units incorporating plastics parts are: Carrier Corp., Syracuse, N.Y.; Chrysler Corp., Airtemp Div., Detroit, Mich.; Cory Corp., Chicago, Ill.; Crosley Div., Avco Mfg. Corp., Cincinnati, Ohio; General Electric Co., Bloomfield, N.J.; International Harvester Co., Chicago, Ill.; Mitchell Mfg. Co., Chicago, Ill.; Philco Corp., Philadelphia, Pa.; RCA-Victor Div., Radio Corp. of America, Camden, N.J.; Robbins & Myers, Inc., Memphis, Tenn.; Servel, Inc., Evansville, Ind.; O. A. Sutton Corp., Wichita, Kan.; Victor Products Corp., Hagerstown, Md.; York Corp., York, Pa.

Plastics Parts

Primary use of plastics is in the cabinet that projects into the room and through which the dehumidified, cooled, and filtered air passes. Projecting outside the room is the ex-

Smartly styled room air conditioner by Servel, Inc., is housed in styrene cabinet molded in one piece by General Electric Co., Chemical Div. Each section of the four-piece grille can be individually adjusted. Single acrylic dial on top of unit controls entire operation



Rounded ends of styrene louvres (bottom) rotate in circular grooves molded-into sides of styrene bezel (center) for Crosley grille. Molding is by Cambridge Molded Plastics Co.

terior cabinet, which sucks in the air to be conditioned.

All of the exterior cabinets which have been built to date have been fabricated of metal. But one leading company in the field already has plans on the drawing board for an exterior cabinet to be formed of resin-impregnated fibrous glass.

Aside from the plastics housings which have just begun to make their mark on the industry, the biggest plastic pieces—and, by far, the largest volume-wise—are the adjustable grilles which control the direction of air flow. Styrene—both medium-impact and high-impact—has captured the greater share of both the grilles and the frames that hold them in place.

On one model, however, produced by Mitchell Mfg. Co., grilles and frames are molded of general-purpose phenolic. Since this particular unit is designed to function either as an air cooler or as an air heater, it was necessary to utilize a thermosetting material. In order to gain Underwriter's approval for the air conditioner, the grilles had to be able to withstand the heat even if the fan should, for some reason, become inoperative.

For the smaller parts of the units—particularly control knobs, decorative name plates, and dials—optically clear, durable acrylic and cellulose acetate butyrate are favored materials. Butyrate is also used in a thermostat housing molded for a Carrier model by Auburn Button Works, Inc., Auburn, N.Y.

. Models produced by Cory are protected from damaging contact with the window by an elastomeric vinyl gasket extruded of Geon resin by Jarrow Products, Chicago, Ill.

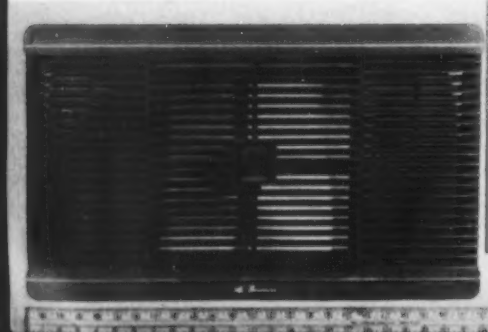
Finally, in the internal operation of the units, plastics offer those advantages that have made them so acceptable in other home appliances. General Electric, for instance, uses oil tubes of polyethylene, Teflon valve seats and valve diaphragms, and phenolic foamed-in-place insulation. In the Vornado model of O. A. Sutton Corp., the terminal block is molded of Bakelite phenolic.

Appearance and Cost

From an over-all viewpoint, plastics have greatly contributed to the acceptance of the room air conditioner on the consumer level.

Attractive appearance—As the final form of the room air conditioner took shape, manufacturers were faced with the problem of creating an interior cabinet that would be decorative as well as practical.

The problem was solved largely with plastics. Molding the grilles and housings of lustrous smooth styrene and phenolic transformed the room air conditioner from a drab appliance to a handsome piece of furni-



Styrene parts molded for an RCA grille (left) by General American Transportation Corp., include (right): 2-lb. frame molded on a 60-oz. H.P.M. and 1-lb. square grille molded on 20-oz. Reed-Prentice. Steel shaft and spring inserted behind the grille permit it to be pulled out and rotated to the desired position

ture. Designers discovered a new flexibility in styling that permitted the creation of fresh, smart-looking lines to blend with any type of room decor, modern or traditional.

Each front or grille of the many models currently on the market is characterized by a striking individuality and originality. In some cases, the manufacturer will retain the identical metal cabinet and change only the styling of the grilles or front to effect a new model design.

The handsome integral coloring of the plastics parts will not fade in the sunlight and smudges or dirt can easily be wiped off. Since the color is integral to the part, scratches caused by handling are hardly noticeable.

Physical properties—In the operation of the room air conditioner, durable plastics play a functional part as well. Excellent thermal and acoustical insulation properties contribute to more efficient and smoother, quieter performance. Plastics are non-rusting and impervious to the moisture and condensates encountered. The sweating so common with metal is eliminated.

Cost—By the end of this year, it is estimated that the number of companies manufacturing or distributing air conditioners will have tripled to 68. In an expanding situation such as this, cost considerations develop into a prime marketing problem.

To meet this challenge, many new plastics parts have been incorporated, reducing the costs of production, finishing, and assembly. Metal grilles and housings similar to those of plastics now being used would be difficult, expensive, and time-consuming to fabricate. In contrast, the plastics parts require no finishing, are few in number because of molding potentialities, and those few parts can be assembled quickly and with a minimum of effort.

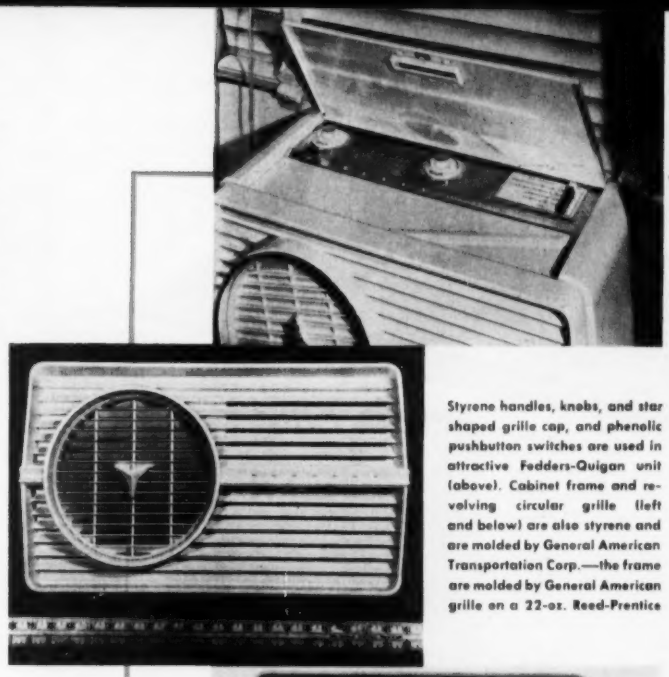
Assembly

Typical molded-in features which facilitate assembly are found in the "rotating-spring" grille. This type of grille is used in units molded for Mitchell by Chicago Molded Products Co., Chicago, Ill.; for Servel by General Electric Co., Chemical Div., Pittsfield, Mass.; for RCA-Victor by Mack Molding Co., Arlington, Vt.; and another for RCA-Victor by General American Transportation Corp., Chicago, Ill.

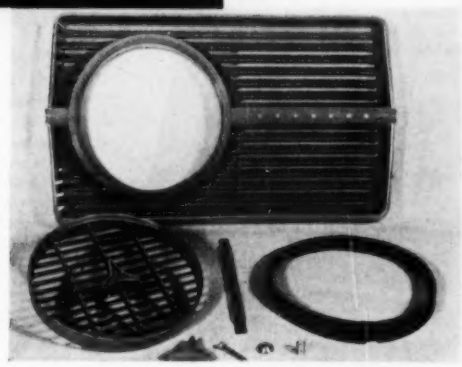
Essentially, the parts of all "rotating-spring" grilles operate in the same way. Only two different pieces are actually needed—a frame with a molded-in cross bar and the grille itself. A steel shaft is run from a hole in the grille through a molded-in opening in the cross bar. Behind the bar, a steel spring is fastened to the shaft. When the grille, with molded-in louvres slanting in a fixed direction, is pulled out, it can be rotated to the desired position and allowed to snap into place.

Fabrication costs on a metal grille similar to the "rotating-spring" model would be high.

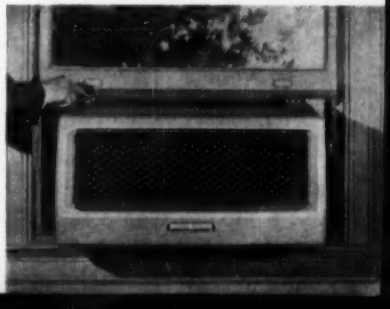
Two other popular types are the



Styrene handles, knobs, and star shaped grille cap, and phenolic pushbutton switches are used in attractive Fedders-Quigan unit (above). Cabinet frame and revolving circular grille (left and below) are also styrene and are molded by General American Transportation Corp.—the frame are molded by General American grille on a 22-oz. Reed-Prentice

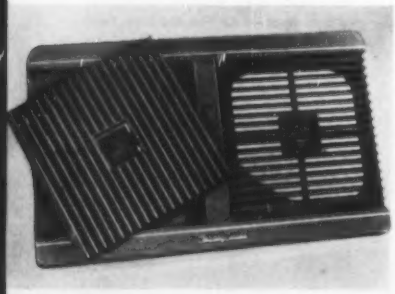


General Electric room air conditioner has five styrene parts—a 2-lb. front panel molded in single-cavity mold on 48-oz. machine; a 22-oz. frame; and 3 adjustable disks injection molded in a 2-cavity mold on 8-oz. machine. Parts are assembled to unit by spring clips



Entire front styrene section (above) of Mitchell Mfg. Co. unit (top) is molded by Amos Molded Plastics in three parts (left)—prow-shaped frame with integral tilted bottom louvres designed for air intake, and two reversible grilles. Frame is molded on a 32-oz. machine and each grille on a 4-oz. machine

Frame and grilles for RCA unit are molded of styrene by Mack Molding Co. To obtain high clamping pressure, frame is produced on a 300-oz. machine. The reversible grilles are molded on a 48-oz. machine and mounted to frame with springs, sleeves, and screws



"circular-rotating" and the "individual louvre" models. The "circular-rotating" type is illustrated by the O. A. Sutton model, molded by Kuhlman Plastics Co., Kansas City, Mo. In this assembly, the circular outlet nozzle revolves freely around two pins molded-into the inner rim of the one-piece plastic outlet nozzle ring. On a rotating Fedders-Quigan grille, molded by General American Transportation Corp., the entire circular unit turns on a shaft.

"Individual louvre" grilles, are exemplified by the Mitchell unit molded by Cambridge Molded Plastics Co., Cambridge, Ohio. Rounded triangular ends of each individual louvre are held in place in hemispherical ridges molded along the sides of the frame. The ends, however, are free to move within the ridges and can be individually adjusted in any desired direction.

Expansion Plans

Taking into account the expansion plans formulated by many of the companies, the amount of plastics that will be involved in room air conditioners will reach huge proportions. Servel, which is planning an extensive marketing program for its room air conditioner units in 1953, uses 2½ lb. of styrene in each frame and grille. Mitchell, which intends to double its sales this year of room air conditioners alone, uses 2 lb. of phenolic in the grille and frame of one model. And every other manufacturer, with equally large parts, is forging steadily ahead.

In molding the grilles, the talents of both the product designer and the molder were effectively combined to produce a part as functional as it is decorative. As an end result of this cooperation, each part produced represents the carefully worked out solution to complex individual design problems.

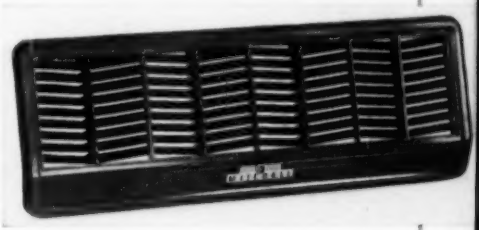
The Crosley grille, one example of the fine work being achieved, is molded of Dow 777 medium-impact styrene by Chicago Molded Products Co. as a two-operation job—the frame in one mold and the individual louvres from a combination mold. A different problem was solved by the same company in producing a model for Mitchell Co., using Bakelite's phenolic. For this job, a combination of compression molding and transfer molding was used. For the flat, shallow outside bezel of the grille, compression molding was ideal; for the relatively thin louvre sections, transfer molding maintained the necessary detail and reduced the required finishing.

Another Mitchell front and grille unit is molded by Amos Molded Plastics, Edinburg, Ind. using Dow's medium-impact styrene. Molding is done with a straight draw, the core and cavity "sawtoothing" together to produce a prow-like design.

On the Crosley grille molded by Cambridge Molded Plastics, the heavy boss sections of the bezel required close control of heat, pressure, and cure to eliminate sinks.

Designs of other grilles illustrated in this article were equally success-

Since air conditioning unit (left) of Mitchell Mfg. Co. functions both as air cooler and air heater, grille (right) is molded of phenolic by Chicago Molded Products Corp. Flat bezel is compression molded on a 430-ton press; louvres are transfer molded in a 4-cavity mold on a 520-ton double ram press



ful in achieving both simplicity of design and ease in molding and assembly.

Molded-in Features

To eliminate the need for finishing or hand tooling, all design features are molded-in. To accomplish this often requires precise and carefully controlled operation. For example, one grille of a Hotpoint air conditioner unit is molded by Northwest Plastics, Inc., St. Paul, Minn., using Monsanto's Lustrex LHA medium-impact styrene. While the bottom half of the piece is level, the upper part has two sides that slope down at a 30° angle. In the mold, the force and cavity were designed to locate the parting line on the bottom surface but to allow the face of the grille to be made with the required slope. The cavities are actually level in appearance, but all of the milling, matching, and fitting is done on a 30° angle.

To cut assembly costs and speed up the molding cycle, the tendency has been to use molded-in inserts on the smaller pieces and to employ coring and thread cutting screws on those larger pieces which do not require frequent assembly or disassembly.

Three grilles and front panels being molded by General Electric, illustrate a trend toward assembly of larger pieces. For a General Electric window-type air conditioner, the front panel, molded of styrene in a single-cavity mold on a 48-oz. machine, is assembled to the styrene bezel with metal clips. A 27½-in. long front panel for a York model, which is molded on a 60-oz. injection machine using Dow's medium-impact styrene, and the grilles, molded in a 2-cavity mold on a 9-oz. machine, are assembled with thread-cutting screws. A similar assembly is used on a Philco model, molded of Bakelite medium-impact styrene on a 48-oz. machine.

Extrusion

The only grille making use of extruded parts is in a model being produced for Cory. Slats for this grille are extruded by Jarrow Products. A continuous hole through each slat provides an opening for metal bearings which permit individual hand adjustment of each slat.

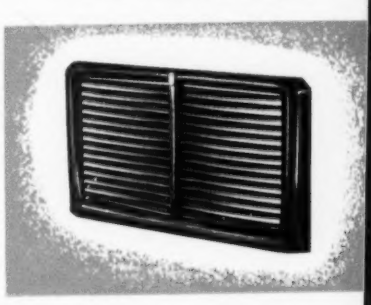
Nameplates and Dials

Toughness and optical clarity make acrylic and butyrate especially suited for the molding of decorative nameplates and dials. The handsome large Servel dial, for example, is a major selling feature for that company's units. Kent Plastics, Evansville, Ind., molds the attractive part in acrylic and colors it in four vivid shades—red, blue, golden gray, and gold—using opaque paints, metallescent paints, and vacuum plating.

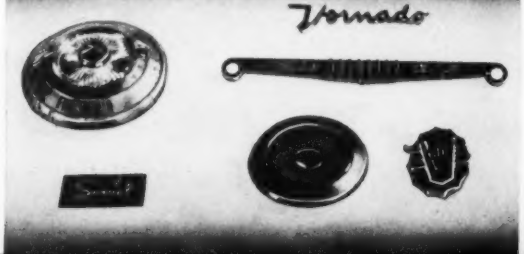
For the nameplates for O. A. Sutton Corp., toughness was the essential quality desired. The parts are assembled to the cabinet by Tinnerman fasteners. By using butyrate parts, molded by the Gits Molding Corp., Chicago, Ill., the breakage

(*Continued on p.* 186)

Stationary right hand louvres for Crosley Co. grille are molded by Chicago Molded Products Corp. with square ends; adjustable left hand louvres have round ends. Frame, louvres are styrene



Dials and nameplates are decorated by painting and vacuum plating. Methacrylate parts (left) are molded for Servel, Inc. by Kent Plastics Corp.; butyrate parts (right) by Gits Molding Corp. for O. A. Sutton Corp.



Typical plastics knobs designed for air conditioning units. Four butyrate knobs (left) are by Rohden Mfg. Co. Three styrene knobs (right) for RCA are molded and hot stamped by Mack Molding Co.

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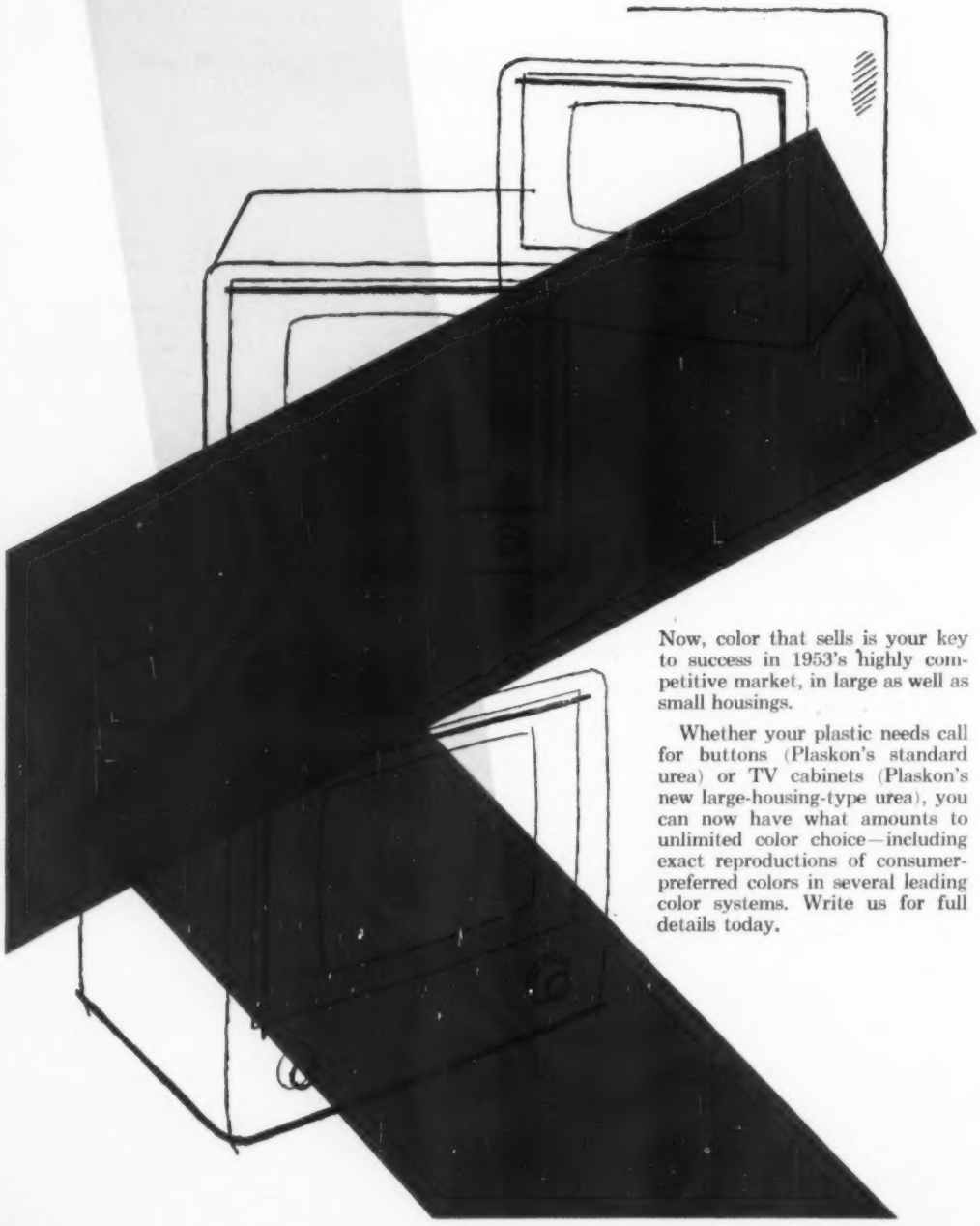

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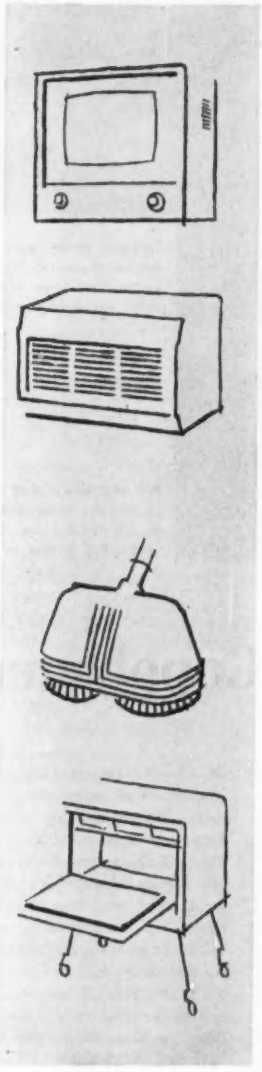

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Housings made of Plaskon's new type of urea are rich in sales appeal: fine detail reproduction, pleasing feel, jewel-like color tone, deep luster, permanent molded-in color.

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In addition to sparkling appearance, housings made of Plaskon's newly developed urea are more durable—highly scratch-, shatter-, and crack-resistant. Lightweight, though plenty strong. Highly resistant to attacks from household acids, greases, solvents, perspiration.

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This new type of Plaskon urea flows freely, yet retains rapid curing characteristics of Plaskon's standard urea. It retains plastic state longer, passes mold obstructions easily, readily forms dense, homogenous mass.

Gorgeous color, too

Your housings will offer something very special in the way of color and added sales appeal. In the first place, this new type of Plaskon urea bounces light from its hard outer skin and refracts it from the translucent depths below the outer surface. Thus your housings offer an appearance of richness, of solid quality.

But that's not all. You have over 11,000 colors to mold into your product. Eleven thousand colors from which to choose the ones that best answer your design problems and sales goals.

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We have much more information to give you on the ways in which this new Plaskon urea has given others and can give you improved large housings with better sales appeal and with greater design and manufacturing latitude. Why not write today for details?

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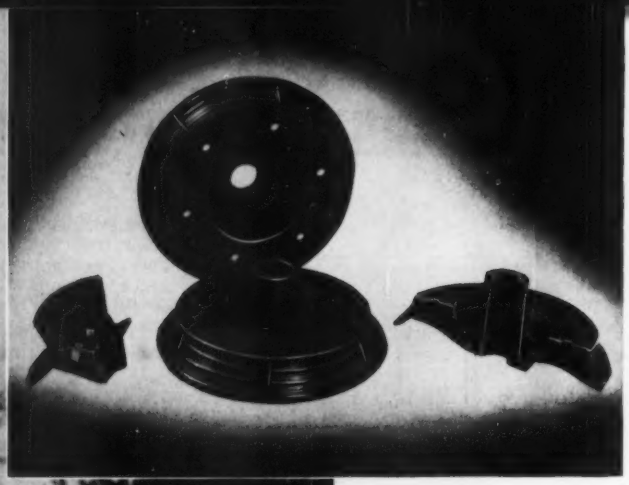


Two-part styrene copolymer wheel (center) is riveted together (cross section, left). Lower half (cut-away, right) has molded-in axle housing

Finished lawn mower wheel, 4 in. in diameter, is stronger than aluminum or cast iron and, together with rubber tire, weighs only 18 ounces

All photos courtesy U. S. Rubber Co.

Lawn Mower Rolls on Copolymer

ANOTHER outstanding application of styrene copolymers has been made possible by the unusual combination of properties that characterizes these versatile plastics materials.

This newest development is a rugged wheel for power lawn mowers, designed by Newark Stove Co., Newark, Ohio, and molded of Kralastic supplied by Naugatuck Chemical Div., U. S. Rubber Co. By comparison with cast aluminum wheels, the styrene copolymer wheels weigh only half as much and cost only half as much to produce. Despite this light weight and low cost, the assembled wheels are reported to be stronger than either aluminum or cast iron; in addition, they are completely self-lubricating for the life of the lawn mower.

Lawn mowers receive rough treatment. They are frequently bounced over rocks, dragged along concrete pavements, or run into walls or trees. It is reported, however, that the new copolymer wheels will neither crack nor split when so abused.

Injection Molded

The wheels are made up of two halves which are similar with the exception of a sleeve-like projection molded into the inner section of one half. This sleeve serves as a housing and also as a bearing for the steel axle shaft.

After the wheel halves are removed from the mold and degated, two halves are riveted together and the tire slipped around the rim. The steel axle is then inserted into the sleeve and fastened in place with washers and nuts. Since the axle rides directly in the housing, it is dipped in light oil during assembly. The oil seals the sleeve and keeps out abrasive particles that might work their way into the sleeve and score the bearing surfaces.

The finished wheel measures 4-in. in diameter and weighs, complete with tire, only 18 ounces. It was designed for use on the 33-lb. Craftsman model lawn mower distributed by Sears, Roebuck and Co.

Grueling Tests

Before the styrene copolymer material was definitely selected for this application, molded parts were subjected to a number of grueling laboratory and field tests. To check the toughness of the material, nails were

One set of the tough, lightweight modified styrene copolymer wheel halves is removed from an injection molding machine by operator

After being cut free of the gate by the operator, both halves are boxed and passed on to the riveting and final assembly stations

driven into molded pieces. The copolymer showed no signs of splitting or cracking under this treatment; neither did it split or crack under the impacts of the riveting operation during production.

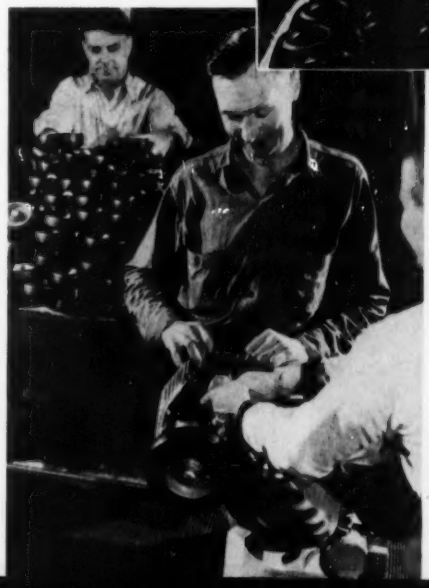
Other tests on the molded parts included drop, temperature, and shock tests. The pieces came through with flying colors. In one drop test, the molded piece was thrown on a concrete pavement with sufficient force to bounce it 10 ft. into the air. The piece did not split.

In temperature tests, Kralastic molded parts were alternately heated and cooled to temperatures as high as 220° F. and as low as —16° F.; the wheel parts did not warp, crack, or discolor.

In one shock test, the molded wheel, under a weight of 70 lb., was rolled over ¼-in. lugs fastened to a hard surface. The test was run at 27 revolutions per minute for 60 hours. As in other tests, there were no adverse effects.

Final proof of the ability of the molded wheels to give satisfactory service was furnished by a 200-hr. field test, approximating two to three years of normal wear. This successful field test was conducted on both hard and sandy ground. No lubrication was used, yet no squeaking was noticed. Examination of the wheels after this extended test showed that the Kralastic housing and the steel axle were mutually polished in use; measured wear at the termination of the field test amounted to only 0.002 to 0.003 inch.

Material from which wheels are molded is so tough that it can withstand the blows of an automatic riveting machine. At station shown at right, six rivets are set and rubber tire applied



After wheels (stacked in background) are secured to axles with washers and nuts, the wheel-and-axle assemblies are attached to the power lawn mower housing. Axle housing, molded as part of one half of the wheel, serves as the bearing, needs no lubricant

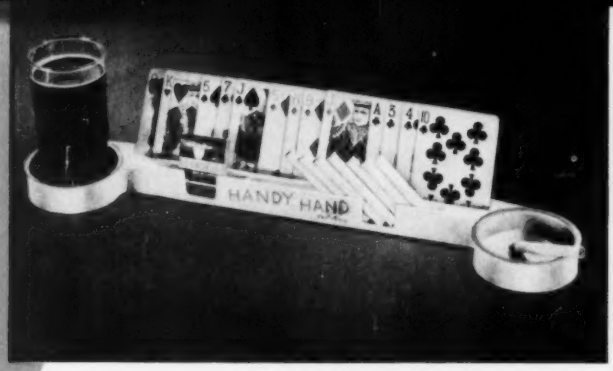
Chips, counters, and checkers, all compression molded of urea, are designed to interlock securely when stacked in piles. Groups of the pieces are individually packaged in separate transparent cellulose acetate tubes which can double as handy, durable poker chip racks. The unbreakable pieces are available in the standard colors from Synthetic Plastic Sales Co., 461 Eight Ave., New York, N. Y.

Flexible polyethylene mixing bowls, designed for hand or electric mixing, cannot dent, shatter, chip, or corrode. The handle of the bowl is shaped for easier gripping and the pointed pouring lip reduces drippings. Bowls are made by Plas-Tex Corp., 2525 Military Ave., Los Angeles 64, Calif.

PLASTICS

Bronze-colored styrene seam ripper is molded with two tooth-like edges—one for ripping double-stitched seams, the other for cutting single-stitched. To protect the garment, the edges curve inward over removable blade. Made by David Traum Co., Inc., 11 E. 26 St., New York, N. Y.

The mess and bother that traditionally accompany baby's feeding time are reduced to a minimum by using an attractive pastel-colored food dish molded of lustrous cellulose acetate. Functional design of the rugged dish includes four sturdy legs and a strong suction cup to prevent the chi'd from tipping the dish over. Made by Westland Plastics, Inc., 3317 E. Pico Blvd., Los Angeles, Calif.



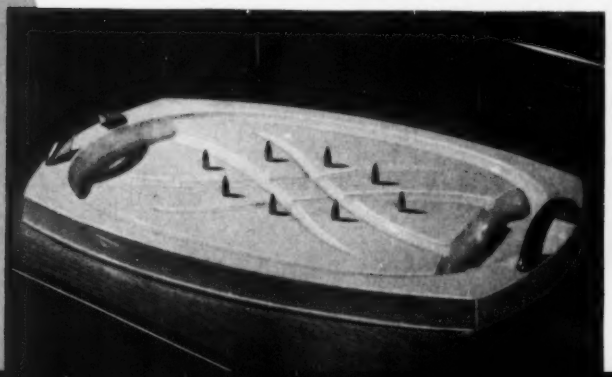
Styrene accessory for easily holding the many cards required in games such as canasta or bridge, also provides convenient space for storing the incidentals that usually clutter a card table—matches, cigarettes, pencils, and pads. Two circular sections at the ends of the accessory double as ashtrays or as coasters for glasses. The unit is made by Handy Hand, 2311 N. W. Johnson St., Portland, Ore.

Weatherproof head for fuel oil tank gages is molded in one piece of Tenite I cellulose acetate. Except for two clear windows through which a dual scale may be read, the entire interior is sprayed with red lacquer. Unit designed by Rochester Mfg. Co., 100 Rockwood St., Rochester, N. Y.

PRODUCTS

Breakage of nursing bottles in the hands of a high-spirited baby is prevented by an inflatable bottle holder fabricated of 12-gage vinyl. Attractively colored, the holder, when inflated, also serves as a toy for the child. Made by Air-Flate, Inc., 47-11 Astoria Blvd. North, Long Island City, N. Y.

Double-welled carving tray molded of styrene has metal spikes press fit into the carving surface to hold the meat fast. The rugged tray, with reinforcing ribs molded-in, is claimed to be heat-resistant and will withstand boiling water. It is easy to clean after it has been used. The tray is available in lustrous walnut or ivory from Aurora Sales Corp., 1615-62 St., Brooklyn 4, N. Y.



Lightweight safety goggles, designed both for greater impact strength and comfortable wear, have a pliable frame molded of Geon vinyl chloride and a durable protective lens blanked from 0.050-in. cellulose acetate. Top and bottom of the frame are gridded for ventilation. Clear rolled edges permit full side vision. Manufacturer is U. S. Safety Service Co., 1215 McGee St., Kansas City, Mo.

Front end of cone-shaped Tenite II cellulose acetate butyrate fishing reel has molded-in finger grip. Back end holds butyrate spool enclosed in metal dome. Mercury Plastics Co., 20787 Mound Rd., Van Dyke, Mich. molds parts for Great Lakes Products, Inc., 8655 Military Ave., Detroit, Mich.

PLASTICS

In commemoration of the British coronation, a handsome painting of the processional is vacuum molded in three dimensions of vinyl. The vivid colors of the scene are silk screened on. A Tudor frame is included in the molding by W. L. Stensgaard & Assoc., Inc., 346 N. Justine St., Chicago, Ill.

For the growing legion of small fry space enthusiasts, the "gun of tomorrow"—complete with super radar sights, blast shield, and cooling fins—is here today. Made of durable high-impact styrene, the toy ejects a harmless nine-ft. paper spiral. A steel spring loader automatically pulls the spiral back into place, ready for reloading. Made by Tigrett Enterprises, 66 East Walton Place, Chicago, Ill.

Three-dimensional Easter eggs molded of Vinylite rigid sheet in two styles—large Panorama eggs with peephole Easter scenes formed in relief at their top half and smaller eggs that can be pushed out of a formed sheet, filled with candy, and tied together. The flexible eggs are lightweight, easy to clean, and will resist distortion in use. Eggs are made by Borkland Mfg. Co., Marion, Ind.

Steel knife blades are permanently mounted in molded Tenite II cellulose acetate butyrate handles at an oblique angle claimed to give a superior leverage for easier cutting. Handles are molded by Perk Mfg. Co., Route 11, Box 904, Tacoma, Wash. for Epi-Carve, 461 Virginia St., Seattle, Wash.

PRODUCTS

Consumer eye appeal is added to a sleek 3-way plug for an extension cord set molded either in a white urea or a brown phenolic. The cap included in each set is molded to match the plug. The sets are a product of Star-A Electric Mfg. Co., Inc., 269-271 Meserole St., Brooklyn 6, N. Y.

The advantages that have made saran so popular for outdoor upholstery have proved equally as suited for an attractive plaid men's summer cap. The color-fast hat is stain-proof, sweat-proof, unaffected by the weather, and cannot be harmed by rolling or creasing. It is porous for ventilation. Available in red or blue plaid from Jacob Elishewitz & Sons Co., 721 Broadway, New York, N. Y.

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F. B. Stanley, Engineering Editor

Pressure Gage For Injection Molding

by F. E. Towsley and C. E. Beyert

A FAIRLY precise knowledge of the magnitude and variation with time of pressure within the mold can be useful in research on the injection molding process itself, as well as in the practical operation of the molding machine to produce quality moldings at a high production rate.

A pressure gage suitable for measurements during the injection molding cycle must meet stiff specifications. Response must be rapid without sacrificing accuracy; construction must be rugged enough to withstand the regular mechanical shocks occurring during mold opening and closing operations; pressure indication must be made independent of the large and rapid temperature changes encountered in the mold during portions of the cycle; and, the pressure sensing method should not introduce undesirable markings on the molded piece.

The pressure-gaging method used by Gilmore and Spencer[1] was developed to meet a majority of these requirements. Accuracy and speed of response in following pressure changes were suitable, but the unbonded strain gages used to convert the pressure-induced strain to a recordable electric signal were not dependable, in the particular form of mounting used. The strain-gage assembly frequently had to be removed for repairs or readjustments. Although the molded piece was marked on one surface, this was no great disadvantage with many molded objects.

Another method for the conversion of strain to an electric signal has been found useful in improving the ruggedness and dependability performance of this type of gage. This method makes use of a mutual inductance between two coils as an indicator of pressure changes in the mold. Accordingly it is called the Mutual Inductance Pressure Gage (MIPG) for convenience in description. The MIPG combines the mechanical elements of the Gilmore-Spencer gage with an improved electrical recording system.

Gage Principle

The MIPG utilizes a close-fitting plug or piston inserted into a circular opening in one wall of the mold (Fig. 1). Hot plastic material under pressure in the mold then exerts a force on the mold-cavity end of the piston. The other end of the piston is backed by a compression spring. Thus the piston moves away from the mold cavity until the spring compression and mold-pressure forces are equal. A measurement of the movement or deflection of the piston then provides an indication of pressure existing in the mold cavity. The spring is a hollow steel cylinder, with wall thickness (spring constant) adjusted to give 0.0025 in. motion for a change in the cavity from zero to peak pressure of about 20,000 p.s.i. As material in the mold cavity cools, pressure decreases and the piston returns toward the zero pressure position.

A shaft, fixed to the steel spring, moves back and forth with the piston. This shaft serves to bring the

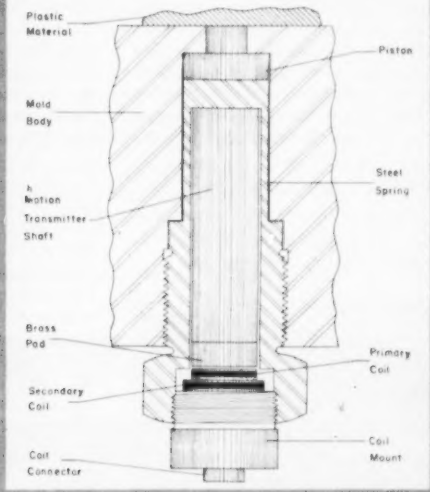


Fig. 1—Section of plug or piston fitted into a circular opening in one wall of the mold. Here the hot plastic material exerts a force on the mold-cavity end of the piston while the other end is backed by a spring

* Reg. U. S. Pat. Off.
† The Dow Chemical Co., Midland, Mich.
[1] "Role of Pressure, Temperature, and Time in the Injection Molding Process," G. D. Gilmore and R. S. Spencer, MODERN PLASTICS, 27, 143, (April, 1950).

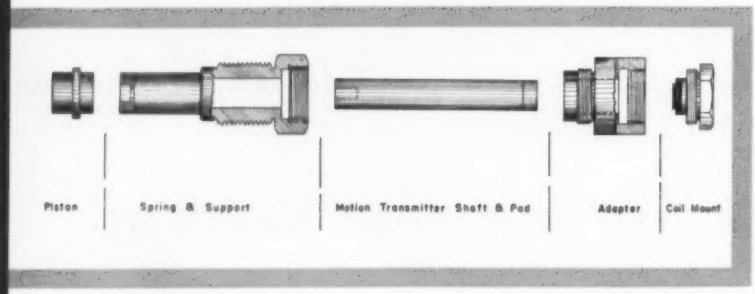


Fig. 2—Parts layout for the sensing unit or pressure pick-up head of the gage. These parts, with the exception of the piston, can be used with most suitably prepared molds

motion of the piston out to a point where the mutual inductance coil system may be applied to sense the movement.

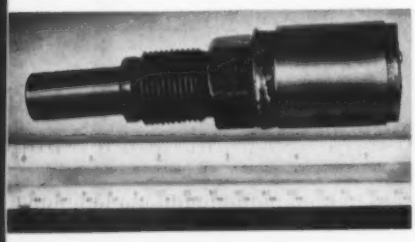
The two coils in the system make up a transformer. Alternating electric current oscillating at 2 megacycles per second is passed through the primary coil. Induced voltage in the secondary coil depends on the spacing between the end of the motion transmitter shaft and the coils. Eddy currents induced in the shaft modify the secondary voltage. When this voltage is indicated by a suitable electronic metering system, the indicator scale may be calibrated in pressure units.

Mechanical Design

Figure 2 shows the parts layout for the sensing unit or pressure pick-up head. The parts are designed to go together in a compact, rugged assembly which may be attached to the injection mold with a minimum of machining operations on the mold itself.

Piston pieces of various diameters may be used for range-changing the gage. Figure 1 shows the piston diameter as considerably smaller than steel spring diameter, while in Fig. 2 the diameters are the same. The smaller diameter pistons require a larger pressure for maximum gage deflection. The flange on the piston keeps it from dropping against and marring the adjacent mold surface.

Fig. 3—Gage head has brass cover to shield transformer from interference



The clearance between the piston piece and the wall of the cylindrical hole in which it operates is about 0.001 in. (one mil). With this small dimension there is very large resistance to flow into the clearance region. In addition, cooling is rapid and the material freezes after only a small penetration of the region. This effectively seals off the clearance space and prevents entry of polymer. The sealing eliminates difficulties due to gradual buildup of material here which might freeze the piston in place, or introduce excessive friction between piston and cylinder wall.

However, if the steel corrodes, with build-up of a layer of corrosion products on the piston or cylinder surface, excessive friction difficulties will develop as the corrosion layer fills in the clearance space. The remedy for this problem is to inspect and clean the piston and cylinder periodically, and to keep the assembly dry. During an operating period of six months, we have had to clean these surfaces once. This was probably the result of a water spill on the assembly; the corrosion problem is not a serious one.

The spring piece is supported in the mold by the outside threaded section with positive positioning determined by the shoulder at the base of the spring cylinder. The final fitting of spring piece, piston, and mold is done by taking fine cuts on either face of the piston piece, with shims inserted between piston and spring if required. The objective here is to obtain a flush fit of the piston surface with the cavity wall. If the wall has a slight draft, the fitting is adjusted for minimum interference with ejection of the molded piece, as shown in Fig. 9 of the Gilmore-Spencer article. With this arrangement, an individual piston piece goes with each mold assembly, while a single pressure head (the parts of Fig. 2 excluding the piston piece) can be used with any of the prepared molds.

The marking left on the surface of the molded article is a circle (Fig. 17 of the Gilmore-Spencer article). The surface plane of this circle is usually at a one or two degree angle to the piece surface, due to the drafting of the mold wall.

Spring Design

Several factors must be considered in steel spring design.

A) The mutual inductance pick-up is limited in sensitivity. It cannot reliably detect movements smaller than the amount corresponding to the electrical zero fluctuation of the instrument. This zero drift corresponds to 20 or 30 micro-in. with the present electronic circuit. Desirable full-scale deflection should be much larger than this, preferably one hundred or more times the zero drift, in order to have 1% precision or better in the pressure measurement.

B) The molded piece may sometimes be ejected before mold pressure returns to zero. The resulting raised area (boss) on the piece may cause scoring or sticking. This puts an upper limit on usable peak deflection, unless the gage opening is located on the front or back surfaces of the mold, where the boss does not interfere with piece ejection.

C) If the steel in the spring is compressed beyond its yield point, the resulting permanent set will produce an undesirable gage calibration shift with time.

D) The spring cylinder diameter should be large enough for convenient machining of the unit.

The spring as designed has a peak deflection of 2 to 3 mils at 20,000 p.s.i. in the mold cavity. In use, there has been no difficulty with ejection or scoring except when other surfaces of the piece were also scored; i.e., when the mold was

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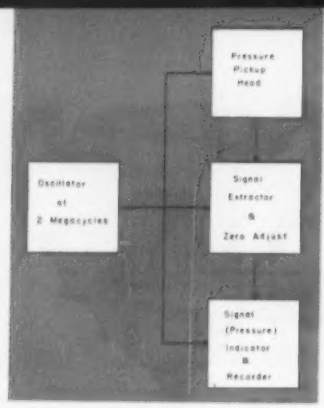

Fig. 4—Oscillator of gage supplies voltage to primary of the pickup unit

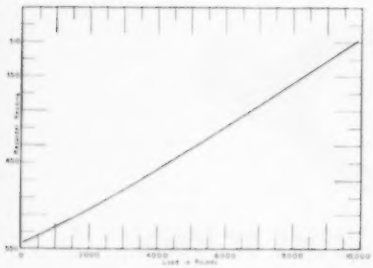

Fig. 5—Calibration curve gives picture of pressure behavior against time

over-packed. The peak deflection occurs at a spring compression pressure of about 60,000 p.s.i. The yield stress in tension for the stronger steels (the spring piece material is tool steel, hardened after machining) is in this pressure range, and the compression yield stress should be at least equal to the tension yield stress. Repeated calibration runs have shown no permanent set in the stressed cylinder, so that the compression yield point is evidently above the 60,000 p.s.i. figure.

Analysis of the stress problem—axial loading of a thin-walled cylinder—provides an equation for determination of the cylinder wall thickness.

$$T = \frac{LAP}{CDE}$$ where

T = Cylinder length (1¼ inch).

L = Cylinder length (1¼ inch).

A = Piston area on cavity side (¾ in. diameter circle).

P = Expected peak cavity pressure (20,000 p.s.i.)

C = Cylinder circumference (¾ in. diameter circle).

D = Peak deflection of cylinder (2.5 mils).

E = Elasticity modulus of steel (29×10^6 p.s.i.).

With the dimensions shown, T is nearly 0.070 inch. This wall thickness was used in the spring and the mutual inductance pick-up then has the function of providing full scale indicator movement for the 2.5 mil deflection of the motion transmitter shaft. The 2.5 mils is an approximate figure for the peak deflection, which is difficult to measure exactly. The stress formula gives assurance that peak deflection will be in the vicinity of 2.5 mils, and this is sufficient information for designing the rest of the instrument.

The motion transmitter shaft has a brass pad on the end toward the coils. This is to furnish good electrical conductivity in the surface adjacent to the transformer coils, which helps to increase the mutual inductance change when the motion transmitter deflects.

Electrical Design

The brass cover which shields the transformer from outside interfering signals is shown in the photograph of the head assembly (Fig. 3). Electrical connection to the coil mount is made by a 4-prong Jones plug.

The mutual inductance deflection detector has the function of reliably indicating the displacement of the motion transmitter shaft. The full-scale deflection is 2.5 mils and it is desirable to have reliability to 1% of full scale indication, as mentioned previously. Greenough and Williams, of the National Bureau of Standards, have developed a mutual inductance detector which will do this job.[2]

We have used the essentials of their circuit, with modifications to enable automatic recording of pressure data and to make it possible to build and maintain the electronic unit out of parts available in the industrial instrument stockroom. The change involves substitution of a multiple diode vacuum tube circuit for the vibrator used in the NBS unit. Sensitivity is decreased by this substitution—the NBS gage has full-scale deflection of 1 mil or less, while our full-scale deflection needs to be 2.5 mils for the 1% reliability. However, this sensitivity has proved to be adequate for our use with negligible maintenance or adjustment attention being required.

The principle and circuit essentials are described in the NBS article and need not be reproduced in detail here. A brief description of the circuit operation will show how the zero adjust and calibrate adjust controls are used to make the instrument ready for pressure measurements.

The oscillator (Fig. 4) supplies a voltage V_P to the primary coil of the pick-up unit. Voltage V_S is induced in the secondary. V_S varies by 5% as the motion transmitter shaft deflects 2.5 mils. This 5% voltage variation then corresponds to full-scale electrical indication of pressure and if 1% reliability is desired, V_S must be dependably measured to 1% of 5% or 0.05%.

This is done by first converting the two voltages into proportional direct currents, I_P and I_S. A fraction, F, of current I_P is subtracted electronically from I_S. The difference current—which is the output of the signal extractor unit—is the electric signal proportional to pressure. F is controlled by the zero-adjust knob, which is adjusted with the gage in place and zero pressure in the mold, to make $(I_S - FI_P)$ zero. In practice, the operator adjusts the knob to set the indicator of the Brown Electronik Recorder at the zero line on the recorder strip chart.

As pressure increases, with material entering the cavity, the difference current increases from zero. Connections are made to the recorder to measure this current, which is thus indicated and recorded on the strip chart.

The strip chart may then be calibrated in pressure units. Pressure zero is at the right side of the strip chart and pressure increases drive the pen to the left. With this arrangement the strip chart provides a graph of pressure against time with normal orientation of the coordinates when the chart is laid out on the desk-top, i.e. time increasing to the right and pressure increasing upwards.

Calibration

The gage is calibrated by applying known compression loading to the pressure pick-up head and plotting

[2] M. L. Greenough and W. E. Williams, *Journal of Research of the N.B.S.*, 46, 5, (January, 1951).

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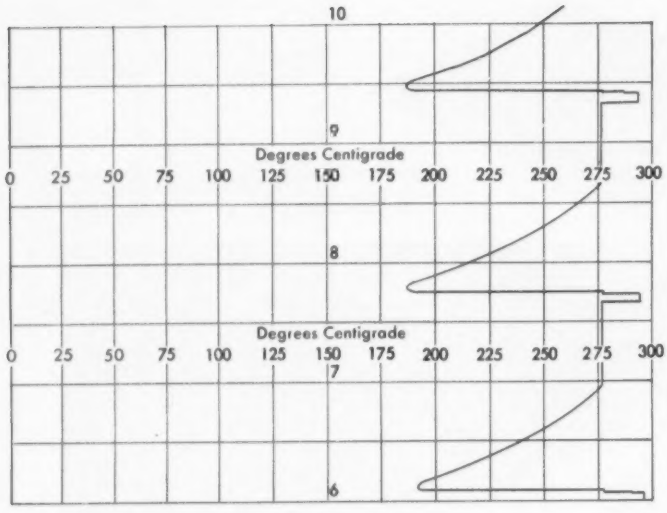


Fig. 6—Typical record obtained with the Mutual Inductance Pressure Gage. In this case the recorder was a fast one, requiring only 4 sec. for full scale traverse

recorder readings against loads. The head is mounted vertically in a steel block with the end of the spring piece exposed for loading. The assembly is compressed between the platens of a universal tester set to apply loads up to 10,000 lb., which corresponds to 22,600 p.s.i. on the ¾ inch circular surface of the head. At peak load, the calibration adjustment control is set to position the recorder indicator at the left side of the strip chart. The adjustment controls the amount of current flowing in the Brown slidewire circuits. This calibration current, I_C, is also derived from and at the same time proportional to V_p, the oscillator output voltage.

The slidewire output is a fraction S of I_P, with S depending on the contact position on the slidewire. The slidewire output and the difference current from the signal extractor are added and the sum is the input current for the Brown amplifier. With this connection, the Brown acts automatically to maintain the amplifier input current at zero, or $SI_C + I_g - FI_p = O$. When pressure changes, S is automatically changed to compensate the change in I_g, with the sum of all currents maintained at zero. The value of S is indicated by the Brown pen position.

This method of measurement, while somewhat involved, has one important advantage. All three of the currents are proportional to oscillator output voltage. If oscillator voltage changes, the current sum remains at zero, with no change in S, because all three currents change in the same proportion. As a result, oscillator output does not have to be limited to variations of the order of 0.05%, which is difficult and expensive to do. The system measures the *ratio* of V_g and V_p, rather than depending on an absolute measurement of V_g while holding V_p constant. Fluctuations of oscillator voltage in the MIPG do not change the scale reading—the system is sensitive only to pressure changes.

A calibration curve is shown in Fig. 5. The slight curvature may be caused by non-linearities in the steel stress-strain characteristic or in the mutual inductance *vs.* deflection relationship. The calibration is sufficiently linear to give a fairly accurate picture of pressure behavior against time on the strip chart. For precision work in research, the calibration curve may be used to obtain accurate pressure values.

There is a slight pen line fluctuation evident when the strip chart runs at zero mold pressure. This is traceable to the diodes in the circuit which have some residual fluctuations due to line voltage shifts or ageing effects. The drift is random in direction, rarely exceeding 1% of the full-scale reading in a half hour. Since pressure always returns to zero during the mold-open portion of the molding cycle, a zero-check and adjustment may be made during this period. However, under normal running conditions, the instrument often is not zeroed for hours. The error due to base line shift is then taken as ±1%.

Gage Performance

The MIPG has been in operation for six months, in a research program on the injection molding process. A typical pressure record is shown in Fig. 6. The recorder used is a fast one, with 4 sec. required for full scale traverse. This speed has been adequate for our work. If greater speed is needed, a faster recorder can be obtained.

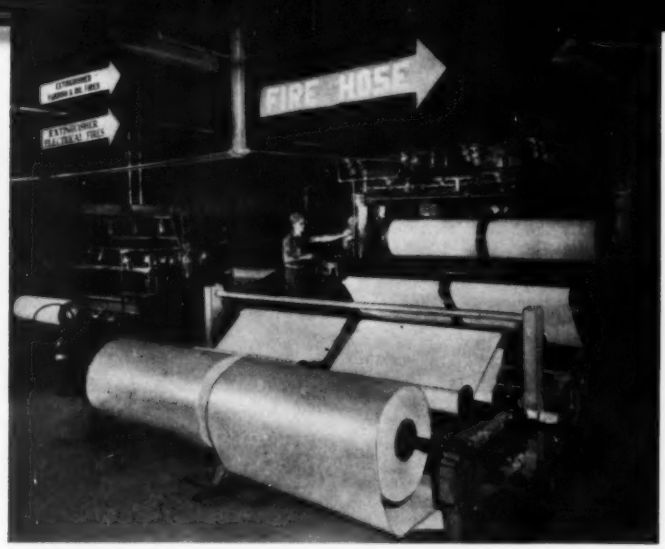
One of the minor difficulties in use has already been mentioned. The surfaces of the piston and cylinder walls must be kept free of corrosion products. Another minor difficulty—typical of instruments with exposed adjustment knobs—has been sudden calibration changes due to someone turning a knob in passing. The remedy, of course, is to lock the adjustments or conceal them. No major defects in use have developed. The gage has been dependable, with little servicing attention required beyond an occasional calibration check.

Applications

The principal utility of the pressure gage is that it gives a direct indication of the condition of material in the mold. Small changes in weight of the molded piece show up as large peak pressure changes. Pressure changes due to material temperature fluctuations from cycle to cycle also are observed as variations of the peak pressure. These observations may be of assistance in keeping "on cycle" in production, and also in shortening the period required to reach stable operating conditions, when the machine is started.

Acknowledgment

We should like to express our appreciation for the able assistance provided by Robert McKee, Jr. and Lowell Putnam in the design and testing of the MIPG.



Coating machines handle highly flammable solutions. Each machine is equipped with fire detectors which, if fire starts, trip valves which promptly release carbon dioxide

Guarding Against Fire

by Walter E. Morgan*

HOW to provide adequate fire protection for the Taylor Fibre Co.'s plant located in the country about six miles outside of Norristown, Pa., was a challenge for the company's management. Having no full-time, paid municipal department to depend on, Taylor developed a fire-protection program which makes the company virtually self-reliant.

The program rests on six principles: 1) Construct only the most fire resistant buildings; 2) Provide water sprinklers in all parts of the plant; 3) Provide first aid fire fighting equipment in quantity for every possible hazard; 4) Install built-in automatic fire extinguishing systems for all extreme hazards; 5) Promote good housekeeping throughout the plant; 6) Organize employee fire brigades for 24 hour coverage of the plant and keep them on their toes through constant training.

A Modern Plant

Taylor's plant comprises nine buildings scattered over a 67-acre tract. With the exception of four small, fieldstone buildings removed some distance from the main structures, all the buildings are less than 20 years old. They are of steel-frame, brick-wall construction and spaced far enough apart to discourage the spread of a severe blaze.

Considerable planning went into laying out production areas. Every effort went into segregating particularly hazardous operations, and throughout the plant and storage areas, wide aisles were provided for the movement of fire fighting equipment and personnel.

Hydrants and Sprinklers

All main buildings are automatic water sprinklered. The system provides basic fire protection for the plant. In addition, hose racks, equipped with 50 ft. of 1¼-in. linen hose, are placed in the buildings so that one or more of them can be used in any area.

Exterior water hydrants with 2½-in. fittings dot the property. Water for the systems is pumped from two wells or the adjoining Schuylkill River.

Using a Worthington steam pump, water is delivered at the rate of 1000 gal. per minute. The water is stored in two aerial tanks of 50,000 gal. each and one 100,000 gal. storage tank. For emergency use, the 130,000 gal. of water in the company swimming pool could be pumped by the company's fire truck at a rate of 300 gal. per minute through 2½-in. hose.

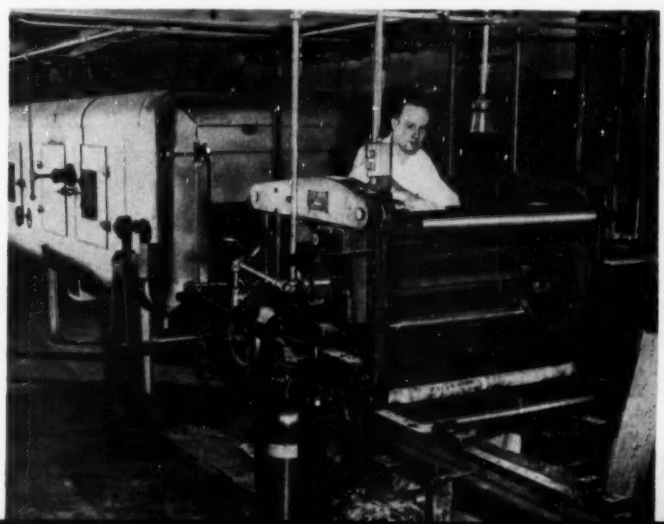
A weekly check is made of the sprinkler-hose-hydrant system and a report on the test is forwarded to the work's plant engineer for inspection.

Carbon Dioxide Systems

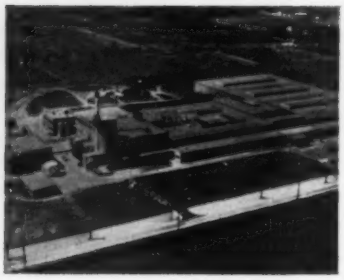
Taylor had three coating processes which it considered particularly hazardous. In each case, a base ma-

(*Continued on p.* 188)

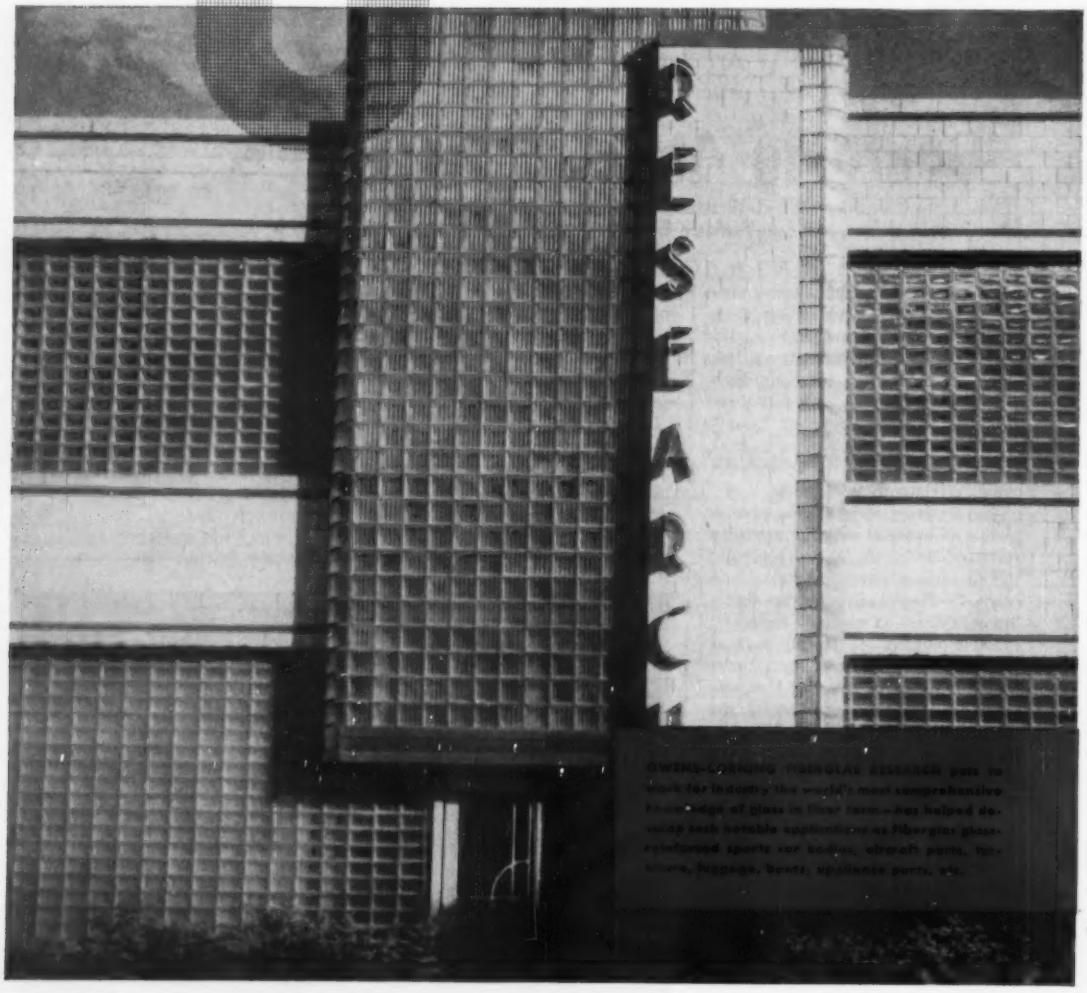
Coating machine and drying tunnel are fully protected against fire by an automatic carbon dioxide system. Note portable carbon dioxide extinguisher for first aid fire fighting



* Manager, Industrial Dept., Walter Kidde & Company, Inc.



BIG REASONS WHY



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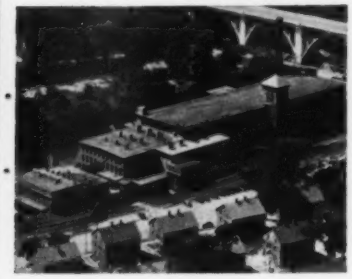

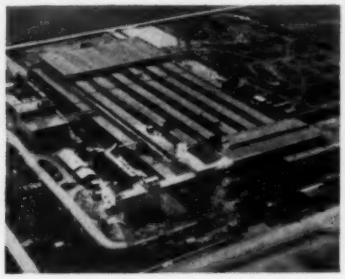

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Six plants where Owens-Corning Fiberglas produces many times more glass in fiber form . . . in more sizes, shapes and types . . . than all other producers combined.

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In lengths for pre-mixed compounds.

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For heavy-duty use, maximum strength

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Fully Automatic Injection Machine

Operated pneumatically and with vertical clamp and horizontal injection, machine is available in 3 and 6 oz. capacities

A FULLY automatic injection machine recently placed on the market by Guy P. Harvey & Son Corp., Leominster, Mass., utilizes a vertical clamp and horizontal injection; capacity is 3 or 6 ounces. Several unusual features are incorporated, the most outstanding of which is pneumatic operation.

The manufacturer states that pneumatic operation was chosen to insure high speed production. The machine may be purchased with its own air compressor and tank as an integral part; it is also available for operation from a central pneumatic accumulator system.

A discharge slide mounted on the rear of the machine acts to positively remove the molded parts from between the mold halves. This same slide can also be arranged to sort molded products from runners and deposit each in separate containers.

Automatic Degating

In order to achieve optimum results in fully automatic operation the manufacturer of these machines states that, as with all types of automatic operation, the molds have to be built more accurately and with automatic operation in mind.

The company states further that it finds that its new machine will automatically operate molds that are so nearly conventional that any mold shop or engineer familiar with standard practices would have no trouble in making the slight variations in the mold design required for fully automatic operation.

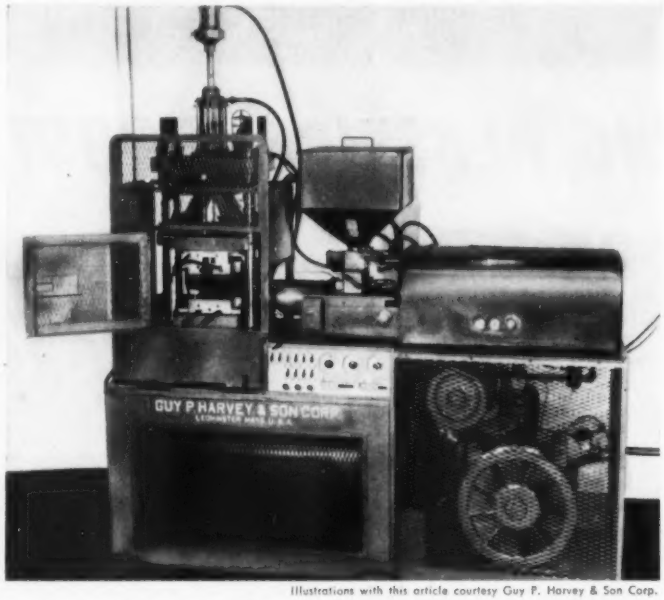
In order to take complete advantage of automatic production, degating during the molding operation is essential. To achieve automatic degating with a minimum of added mold cost, a series of standardized mold shoes featuring completely interchangeable and re-usable components for automatic gate shearing are standard features of the equipment. The company claims that 90% of the applications will lend themselves to automatic degating in the mold proper.

A second means for degating is a slide that mounts on a machine pad on the front of the machine. With this feature and the previously described degating equipment nearly every piece can be automatically degated. The second degating attachment is electrically interlocked into the machine cycle and is so arranged that it comes in between the mold faces and cuts the gates prior to discharging.

Clamping is achieved by an improved leaf-type multiple shear toggle mechanism having substantial squaring heels contacting the movable platen. The toggle pins are hardened alloy steel for shear strength and have standard lubrication fittings.

Tie rods consist of two 2¼-in. rods and one 3⅛-in. hollow rod having calibrated steel adjustment nuts. The large rod is so positioned as to allow the use of indexing or dial feed type of molds.

The two-stage knockout system utilizes a separate pneumatic cylin-

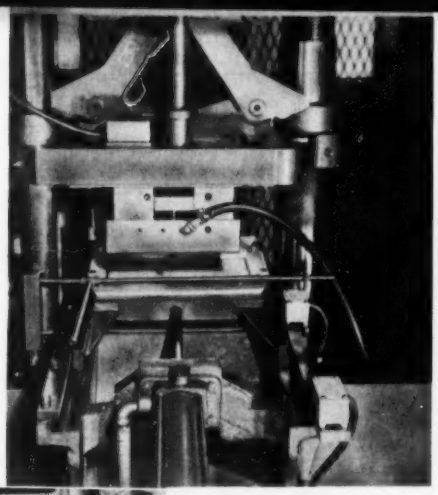


Illustrations with this article courtesy Guy P. Harvey & Son Corp.

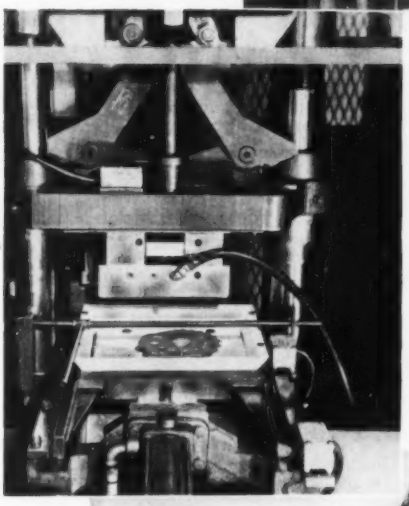
Overall view of new fully automatic injection machine with safety gate open. Discharge and sorting slide, as well as delivery chute, are on other side of the machine

Specifications for New Injection Machine

Oz. per shot—pelletized acetate	3 or 6
Max. shots/hr.—no dwells	900
Max. pres.—p.s.i. on material	12,500
Minimum mold height	7 in.
Maximum mold height	13¾ in.
Maximum mold size	13 by 16 in.
Maximum mold opening	6 in.
Clamping pressure	90 tons
Plasticizing capacity (acetate) per hr.	60 lb.

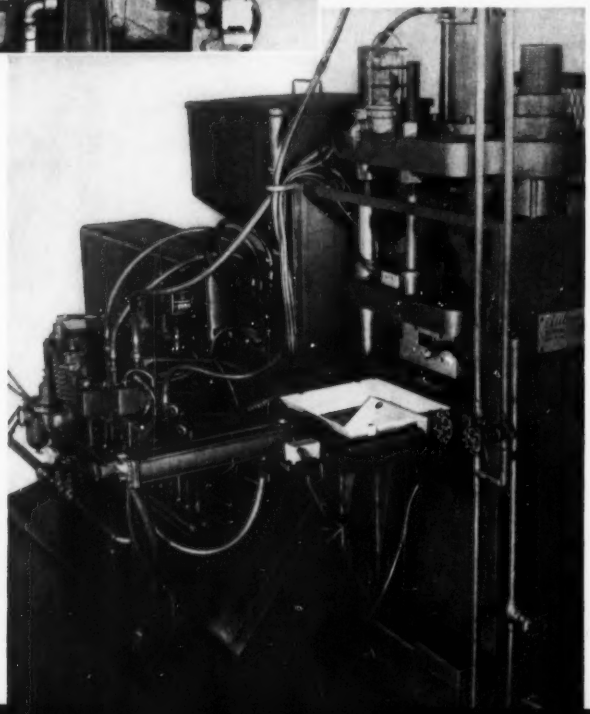


Combination positive discharge and sorting slide has moved into position after opening of the mold and before molded part is ejected. See photograph below



Molded part has been ejected and is resting on trap door of the discharge slide. On far edge of slide is a rubber wiper that assures removal of molded parts even if they have become hung up on the ejector pins

Discharge slide has moved to position over chute and trap door has dropped to deliver piece or pieces. Slide and chute can be divided so as to provide for automatic sorting of different parts from each other



der activating an ejector rod through a hollow clamp cylinder piston rod. This cylinder is electrically interlocked so as to provide an additional ejection motion after the clamp has reached its fully open position and can subsequently be used to move a second ejector plate after clamp movement has stopped or to eject product from mold after the discharge slide is in position. Variable stroke adjustment consists of two adjusting rods with rubber cushions on either side of the toggle mechanism which can be adjusted to limit the stroke travel of the top platen. The same adjusting rods can be utilized to activate the ejector plate on a 2-stage knockout system or may be used to activate a stripper plate when both stripping and a separate knockout system are desired.

Safety Features

"Two-pressure closing" consists of separately regulated closing and clamping pressures. A Microswitch for controlling the clamping pressure is arranged so that it is not actuated until the mold halves are within 0.005 in. of closing. Thus if some foreign object is between mold faces on clamping and the clamp does not apply locking pressure within the time set on the prestalled timer (a fourth time clock located on the rear machine panel), a stall device automatically shuts off heat and power, flashes a trouble signal, and starts a bell ringing.

Safety provisions consist of a fabricated metal frame with removable back and top screens and a swing-type screen gate with an electric safety switch to cut off all clamp and discharge slide power. In addition, an air valve cuts off all pressure to clamp and discharge slide if the safety gate is opened.

An improved heating cylinder design utilizes cartridge type heating elements having tapped holes to facilitate replacement without dismantling the heating cylinder. Cartridges are located in the body of the cylinder adjacent to the spreader. Heating elements are arranged so that the higher concentration of heat is on the plunger end of the cylinder, thereby allowing accurate temperature control with one pyrometer instrument having its thermocouple located in the center of the cylinder.

(Continued on p. 122)

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STYRON 700 withstands high heat sterilization... it is one of several STYRON formulations

Styron® 700 is a high-heat resistant polystyrene that meets the requirements of low cost necessary for an expendable appliance like this Saftiset Blood Filter Unit. Styron 700 has a heat distortion temperature of 20° F. higher than general purpose polystyrene as measured by A.S.T.M. methods. Styron 700, when properly molded on standard injection molding equipment, produces products that can resist temperatures as high as 220° F. before signs of distortion. This Styron formulation is also readily extrudable with high surface gloss and close dimensional tolerances. Extrusion equipment designed for polystyrene is well suited to Styron 700.

In addition to Styron 700 Dow offers a variety of polystyrene formulations that covers a wide range of characteristics.

STYRON 475 is a rigid, tough thermoplastic characterized by a combination of unique physical properties.

STYRON 637 is a light-stabilized grade of polystyrene that readily finds application in lighting fixtures.

STYRON 666 is an excellent general purpose polystyrene developed to provide maximum property values in the end product with maximum ease and speed of fabrication.

STYRON 777 is a medium impact polystyrene with desirable cost and fabrication advantages.

A number of technical service bulletins are available for more detailed information on the Styron formulations. Write THE DOW CHEMICAL COMPANY, Midland, Michigan, *Plastics Department PL 1410.*

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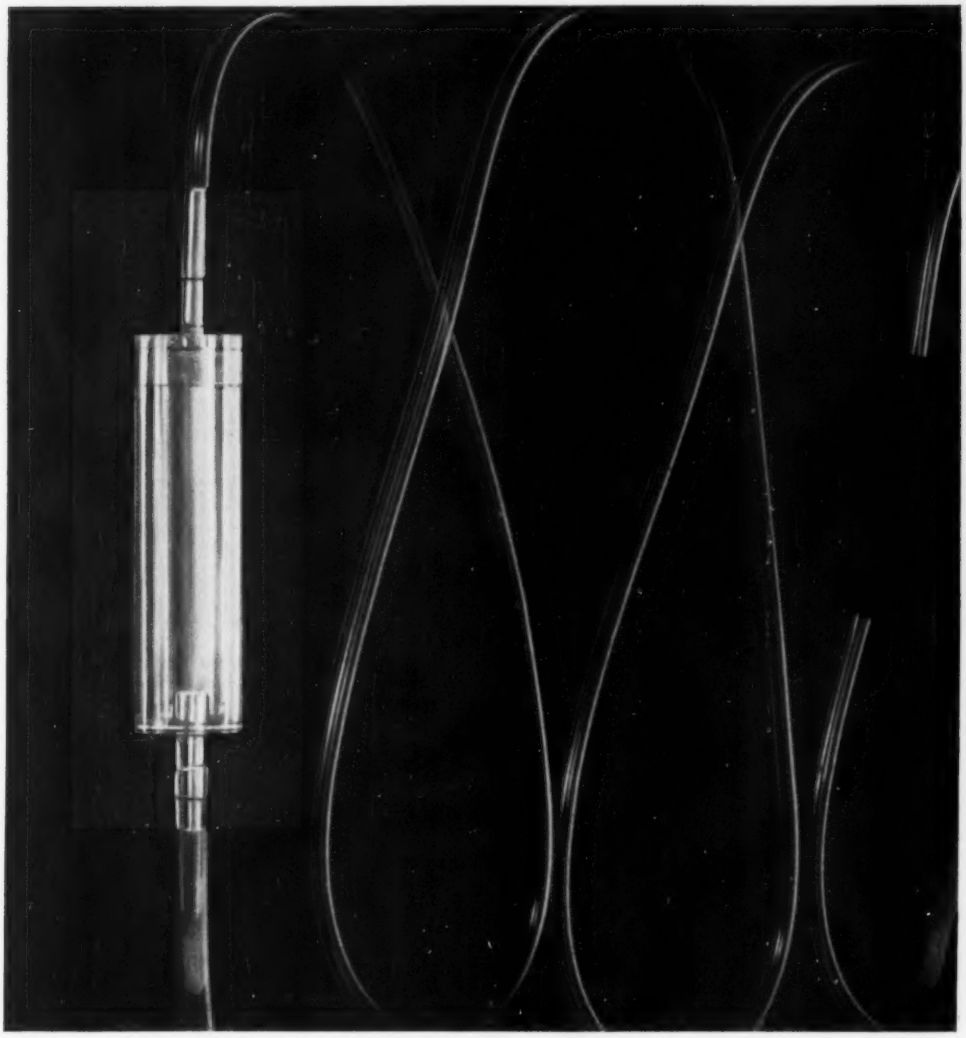

Saftiset Blood Filter Unit molded by Modern Plastics Company of Los Angeles for Cutter Laboratories of Berkeley, California.

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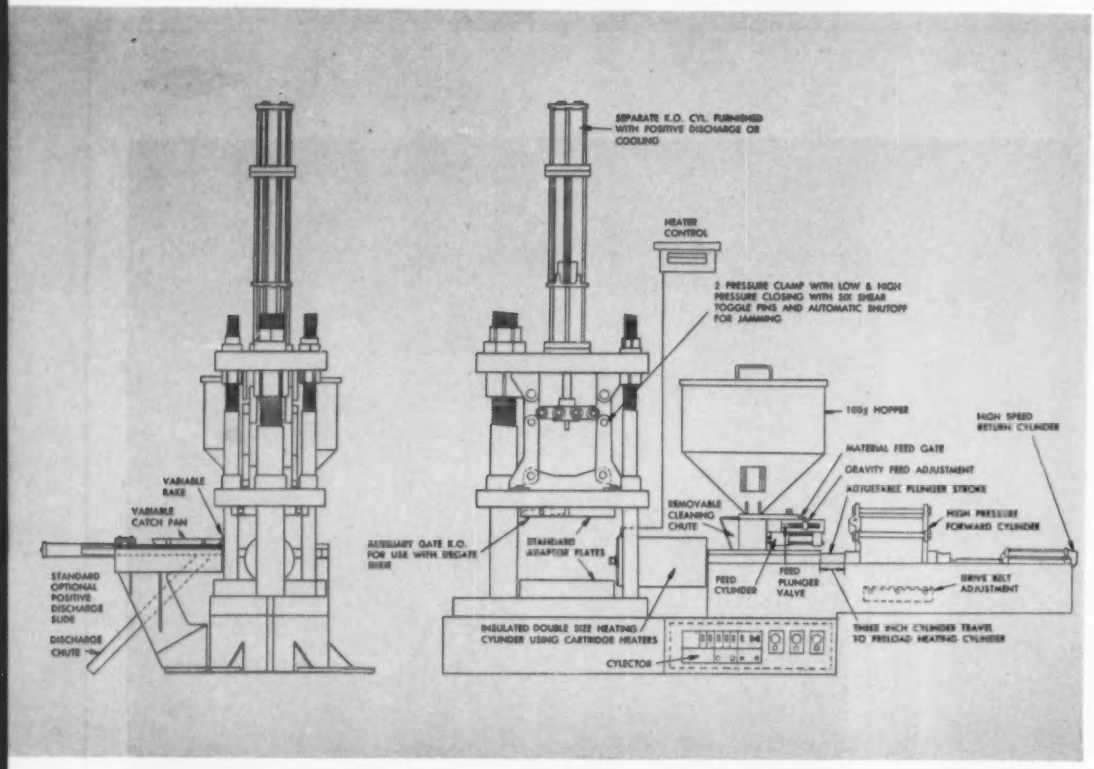
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HEATER CONTROL
2 PRESSURE CLAMP WITH LOW & HIGH PRESSURE CLOSING WITH SIX SHEAR TOGGLE PINS AND AUTOMATIC SHUTOFF FOR JAMMING
100# HOPPER
HIGH SPEED RETURN CYLINDER
MATERIAL FEED GATE
GRAVITY FEED ADJUSTMENT
ADJUSTABLE PLUNGER STROKE
HIGH PRESSURE FORWARD CYLINDER
VARIABLE BASE
VARIABLE CATCH PAN
REMOVABLE CLEANING CHUTE
AUXILIARY GATE K.O. FOR USE WITH DEGATE DIES
STANDARD ADAPTOR PLATES
FEED CYLINDER
FEED PLUNGER VALVE
DRIVE BELT ADJUSTMENT
STANDARD OPTIONAL POSITIVE DISCHARGE SLIDE
DISCHARGE CHUTE
INSULATED DOUBLE SIZE HEATING CYLINDER USING CARTRIDGE HEATERS
THREE INCH CYLINDER TRAVEL TO PRELOAD HEATING CYLINDER
CYLECTOR

End and front views of fully automatic injection machine. See also photos on pages 118 and 119. Variable catch pan or discharge slide, at left in end view, is in discharge position over chute. Operation of this part of the machine is shown in detail in photos on page 119

The cylinder body is surrounded by $\frac{3}{8}$ in. dead-air space over which a stainless steel sealed shell is attached to prevent heat loss. A water cooled hollow plunger can be quickly removed through the back of the injection cylinder.

Measured Feed

A measured feed method is used in which material is loaded from the hopper into a variable size feed chamber. After metering, the measured charge of material is dropped into the feed chute. The measured feed device has a separately controlled pneumatic cylinder and valves.

The combination positive discharge and sorting slide is a mechanism mounted on the back of the machine, arranged so as to come between the mold faces after the mold is opened and before the parts are ejected. On the lead edge of the slide is mounted a rubber wiper that passes over the products without effect on the instroke. After parts are ejected, the wiper passes over the ejector pins to assure removal of any molded parts which might have hung up on the ejector pins. Located in the discharge slide is a replaceable pan having a trap door in the bottom that can be easily divided into a multiplicity of partitions, thereby making it possible to automatically sort different parts from each other. A chute located in the discharge slide may be similarly partitioned to segregate molded parts from the scrap as they are delivered to the chute from the slide in its out position.

Automatic degating is usually simply designed into the mold to take advantage of sorting the molded pieces. In the event of a complicated mold setup where degating cannot be included in the mold, the separate devices already mentioned are available for performing the degating operation.

Standard pneumatic cylinders manufactured by the Hannifin Corp., Chicago, Ill., with stock cups and packing glands, are used throughout. Pneumatic valves, regulators, and flow controls are also Hannifin's standard stock items, the valves having easily replaceable cartridges of which only two sizes are used throughout the machine.

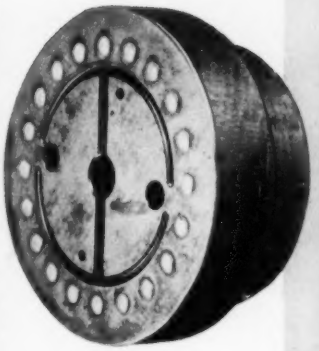
Control Panel

The control panel is of a new design having Eagle Microflex timers and Microswitch elements all grouped in one convenient location for controlling individual manual operations on all cylinders as well as semi-automatic and automatic cycling. Limit switches throughout are standard, non-adjustable Microswitch elements. The temperature control instrument is a Wheelco proportioning pyrometer #M/293.

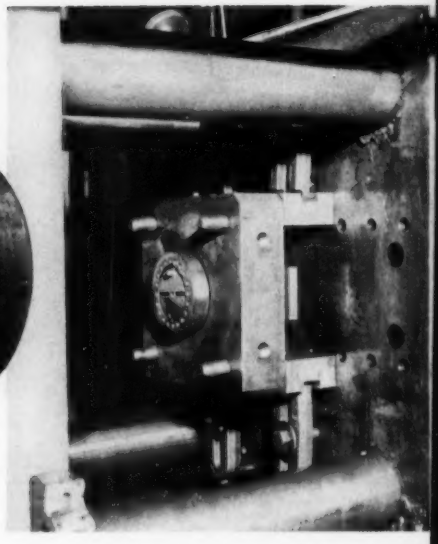
The compressor setup is Ingersoll-Rand's standard #15T unit and will be serviced on request by any Ingersoll-Rand office.

Photos courtesy Automatic Plastic Molding Co.

Rivets, heads of which are to be covered by injection molding, are loaded into a 20-cavity insert mold by converted automatic riveting machine. Mold is indexed automatically



One of the four 20-cavity molds used in production, with the rivets in position. This insert mold is now ready to be mounted in place on the injection machine



Close-up of movable platen of injection machine shows 20-cavity mold mounted in place prior to injection of cellulose acetate butyrate which will completely cover the heads of the metal rivets

Rivets Covered by Injection Molding

BULLARD "hard-boiled" hats are standard protection for many construction workers. To give complete protection from falling tools or other heavy objects, this hat is separated from the head of the worker by a harness inside the hat.

This sturdy harness is assembled to the hat by means of metal rivets, the heads of which are now covered with cellulose acetate butyrate by injection molding.

Automatic Plastic Molding Co., Berkeley, Cal., has developed an ingenious method which makes it possible for one operator on an 8-oz. Reed-Prentice injection machine to cover the heads of 25,000 rivets in an 8-hr. day.

The photographs illustrate various steps in the operation and the equipment which makes this high production rate possible.

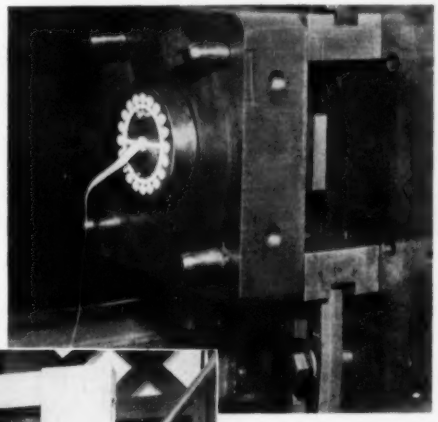


Photo above, taken of movable machine platen just after mold was opened, shows the 20 cavities filled out through their pin point gates

Because the rivets must be a press fit in the multi-cavity insert mold, a special knock-out plate is necessary for removing the shot from the mold. This plate, a disk with inserted pins, is operated by an air cylinder. Rivets are degated by hand brush-off

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PLASTICS*
TECHNICAL SECTION: Dr. Gordon M. Kline, Technical Editor

Plasticity Grading of Fluorothenes

by F. D. Dexter†

THERE are numerous ways to characterize, or differentiate between, various thermoplastics. Many physical tests show some significant differences not only between different materials but also between different grades of the same material. However, few phenomena are as sensitive to variations in the molecular weight as the flow behavior of the molten polymer. This is reflected in the fact that flow, or more popularly termed plasticity, data are an accepted criteria for the classification of many thermoplastic resins and compounds. It is hardly unusual that fluorothene‡ resins have followed this course.

Rheology of Thermoplastics

A knowledge of the flow behavior, or rheology, of molten thermoplastics is of practical value for two primary reasons. First, such information can be used to estimate processing performance and, second, various forms of flow data are useful for classifying different grades of a thermoplastic resin. In either case it is possible to make use of tests which by themselves tell very little about the fundamental rheological properties, and it is economically tempting to curtail activities at this point. However, lacking a background of the actual flow properties invites erroneous interpretation of the data. This is particularly true if different types of resins are being compared. It is the purpose of this section to review very briefly some aspects of thermoplastic rheology with the object of pointing out certain possible pitfalls.

The broadest rheological classification subdivides materials as having Newtonian or non-Newtonian properties. A Newtonian material is one for which the flow rate (rate of shear) is directly proportional to the force causing flow (shear stress). The proportionality constant is, of course, the viscosity coefficient. All materials that do not exhibit this direct proportionality are called non-Newtonian and this classification includes nearly all molten thermoplastics.[2] Obviously, their flow behavior cannot be described by any single constant.

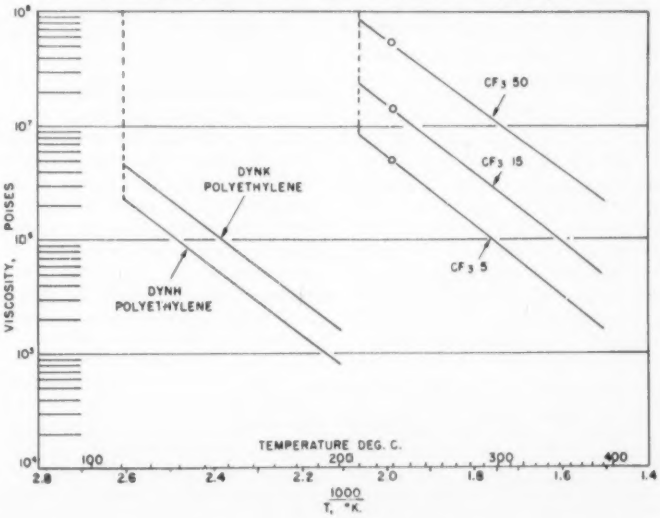
The type of non-Newtonian behavior observed for molten thermoplastics is such that increasing the shear stress causes a more than proportionate increase in the shear rate. Thus as the shear stress is increased the material appears to become softer. While all the fundamental phenomena underlying this performance are not yet understood, it is generally agreed that the existence of some molecular orientation (1)[3] during the flow process is an important factor. Associated with this is the fact that when flow is initiated it takes a certain amount of time for orientation to be achieved. Likewise at the cessation of flow, time is required for the molecules to reassume their random configuration (2). Thus, orientation effects are also responsible, at least in part, for the time dependent flow properties and the elasticity of molten thermoplastics.

The magnitudes of the various viscous, elastic, and associated time dependent effects have been measured but at shear stresses far below any normal processing level and using rather cumbersome techniques (2,5,6). In order to simplify measurements and to approach flow rates of practical significance, it is usually necessary to employ some form of extrusion measurement.

[2] Certain phenol-formaldehyde novolaks provide about the only notable exception. See reference (4).

[3] Numbers in parentheses link to references at end of article.

Fig. 1—Parallel plate plastometer flow data for fluorothene and polyethylene resins



* Reg. U. S. Pat. Off.
† Development Laboratories, Bakelite Co., Div. of Union Carbide and Carbon Corp.
‡ The generic term fluorothene will be used to designate the polymers of monochlorotrifluoroethylene.

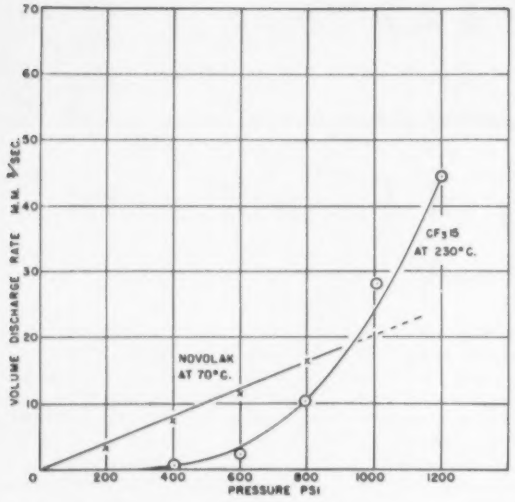


Fig. 2—Above, extrusion plastometer flow data for fluorothene and phenolic novolak resins

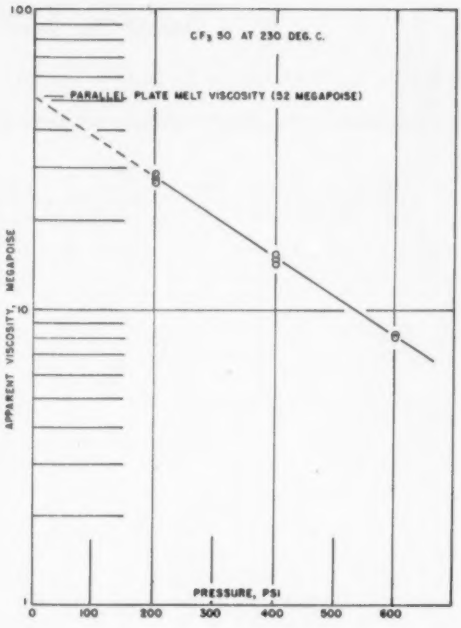


Fig. 3—Right, viscosity versus pressure curve for fluorothene resin

Here material is forced through a die and the rate is measured over a range of applied pressures (10). Although the nature of this rate versus pressure curve is a function of fundamental properties, their combined effects are difficult to separate (3,9,11). Its value, therefore, is limited from a strictly theoretical viewpoint but the data are nonetheless practically useful.

For a Newtonian material one point on an extrusion rate versus pressure curve would suffice to completely characterize the material at the particular temperature. Further, a straight line through this point and zero would define the complete rate versus pressure relation (4). This is not the case for most molten thermoplastics. These non-Newtonian materials exhibit rate versus pressure curves that are convex to the pressure axis. Further, the exact degree of curvature may be different for different materials. For this reason it is unwise to compare the flow behavior of different materials on the basis of a test run at a single pressure, or for that matter on the basis of any single point test.

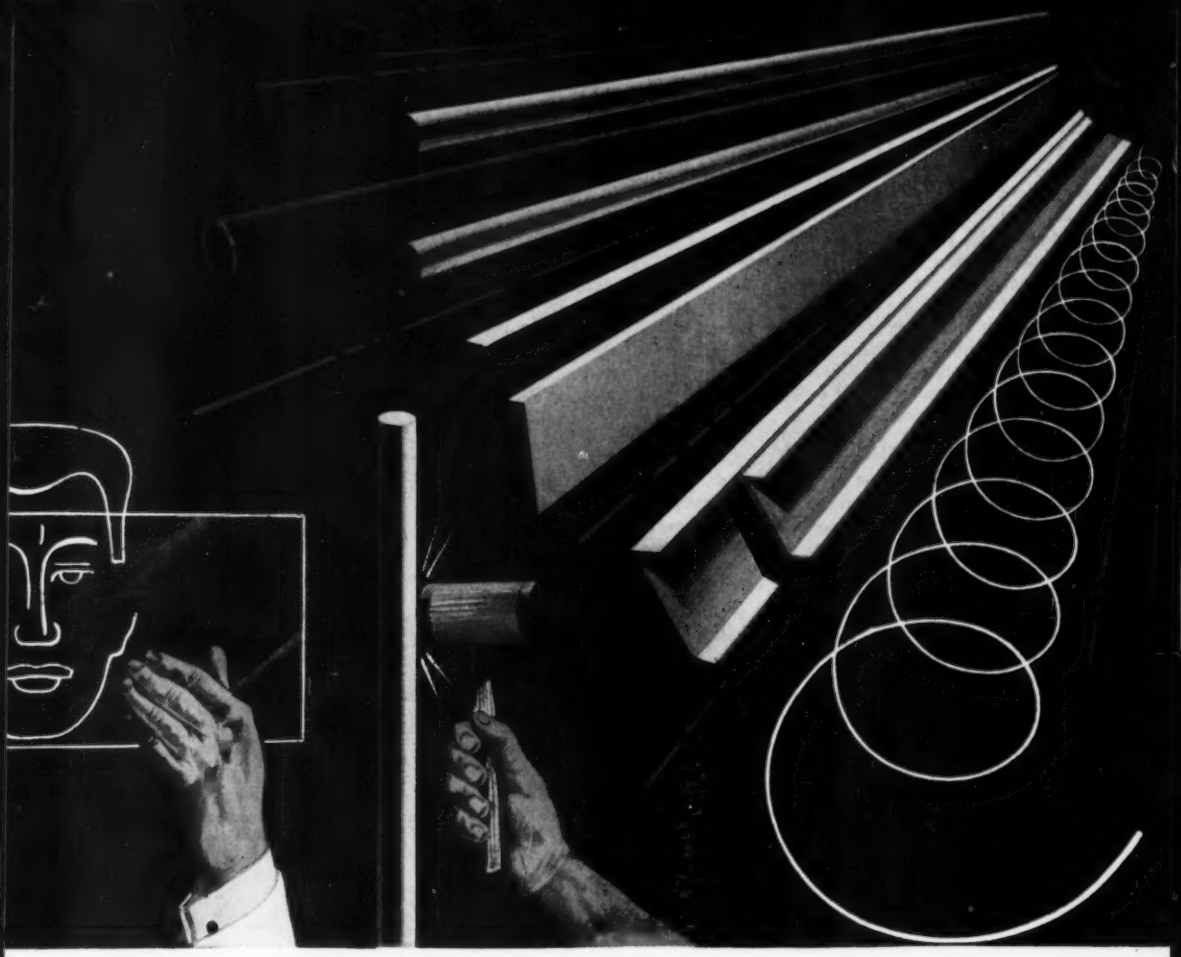
Generally speaking, different grades of the same material will have similarly shaped rate versus pressure curves. Thus, there is less danger in making comparisons on the basis of a single point here than in the case of different materials. However, it seems possible that large changes in molecular weight distribution might destroy this similarity (13). For this reason correlations between tests run at widely different pressures should not be assumed. Further, in all these tests it is a tacit assumption that the characteristics of the material remain constant during the test period. As will be seen this is not necessarily the case for fluorothene resins.

Flow of Fluorothene Resins

Flow data for fluorothene resins were first determined through use of the parallel plate plastometer, which has been discussed in detail elsewhere (6). By use of this instrument a melt viscosity figure is obtained which describes the flow of the material at very low shear stresses. Typical results are shown in Fig. 1, which also shows for comparison similar data on polyethylene. Note that fluorothene exhibits a transition temperature region around 210° C. very much like that for polyethylene which lies about 100° C. lower. Above 210° C. the change in viscosity with temperature can be described by an activation energy for viscous flow of 15 kcal./mol.

In common with many thermoplastic materials, molten fluorothene shows an apparent softening in flow as the shear stress is increased. The nature of this performance is best observed in extrusion plastometer type measurements. Such data, obtained using an instrument patterned after Nason's (10), are shown in Fig. 2. The curve for a phenolic novolak resin, which is substantially Newtonian in its flow behavior, is shown for comparison. For this latter material the rate is related to the pressure through a constant, the coefficient of viscosity (4). This is evidently not the case for the fluorothene resin. To a close approximation the rate is a direct power function of the pressure; in this case the increase in rate is roughly proportional to the 3rd power of the pressure.

At equivalent shear stresses it would be expected that the viscosity obtained by extrusion methods would be equal to that obtained by parallel plate plastometry. Spencer (12) found this to be the case for polystyrene. Following his general method, which involves extrapolating to zero pressure the viscosity versus pressure curve obtained by



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extrusion, good agreement is found for a fluorothene resin. This is illustrated in Fig. 3. Thus, the parallel plate viscosity value is a point on the flow curve at an extremely low shear stress.

On the basis of parallel plate and extrusion data exact equations describing the flow of fluorothene resins could be set up. However, these would assume the existence of a stable material during the flow process. Unfortunately, this may not be the case. Hence, such equations would be of limited practical value and have not been derived.

Classification by Plasticity Tests

The flow behavior of most thermoplastic resins is highly dependent on the molecular weight. Consequently, tests that are primarily a measure of these flow properties are useful for classifying various grades of any given resin. Because of time limitations tests of this nature are usually empirical and at the best represent but one point on a complex flow curve. Thus, while it is desirable to be able to relate such information to fundamental flow behavior, the principle requirements of such a test are 1) ease of operation, 2) speed of operation, 3) ability to differentiate, and 4) precision.

The parallel plate plastometer test classifies fluorothene resins according to their melt viscosity, expressed in megapoises (10^6 poises) at 230° C. Details of this test have been covered by Dienes and Klemm (6). Briefly, it consists of compressing a cylindrical sample between two parallel plates and measuring the thickness as a function of time. From this information, combined with the compressive load and the sample size, the melt viscosity is computed. Fluorothene resins marketed by the Bakelite Company are designated according to this test method. For example, CF_3-50 resin has a melt viscosity of 50 megapoises at 230° C. and CF_3-5 a melt viscosity of 5 megapoises.

The parallel plate instrument is applicable over a wide range of viscosities, it distinguishes well between various fluorothene resin grades, and its precision is acceptable. However, the test itself is fairly time consuming and a certain amount of sample preparation is necessary. Usually a plaque must be pressed, and discs die cut from this and stacked to form the required cylinder.

Another common method of rating fluorothene resins is by the no strength temperature (NST) test (8). Here a sample of specified dimensions is suspended in a small heated chamber, the temperature raised at a fixed rate, and the temperature at which the sample parts is noted. This is the NST. The starting temperature for this test is 410° F. (210° C.).

Generally speaking this test has many of the same advantages and limitations as the parallel plate test. Differences of 10° F. (5.5° C.) are normally considered significant which, with respect to precision, puts this instrument in about the same class as the parallel plate plastometer. The main drawback is that the starting temperature of 210° C. means that NST values will necessarily be equal or greater than this. While this is not important for new resins, many instances are encountered in which resins are thermally degraded to a point where the NST value is meaningless. This is illustrated in Fig. 4 which shows NST versus melt viscosity for a number of resins, both new and thermally abused. Note that the small NST range of 218 to 224° C. covers a wide, and significant, range of melt viscosities.

Another test method which appears to have considerable merit

(Continued on p. 192)

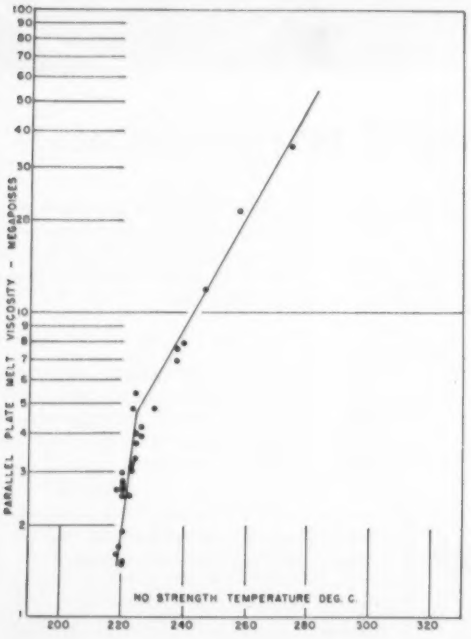

Fig. 4—Left, viscosity versus no strength temperature (NST) curve for fluorothene resins

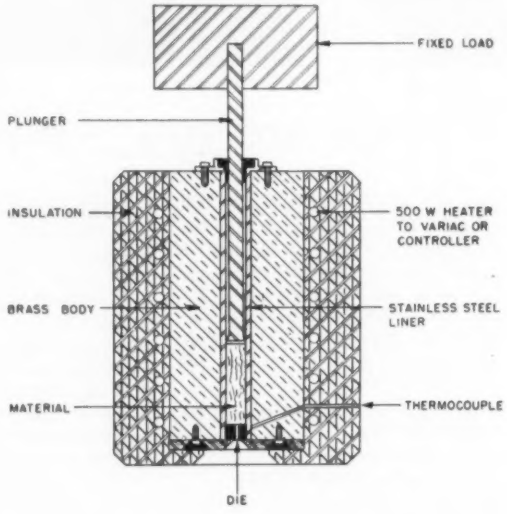

Fig. 5—Above, diagram of the extrusion plastometer

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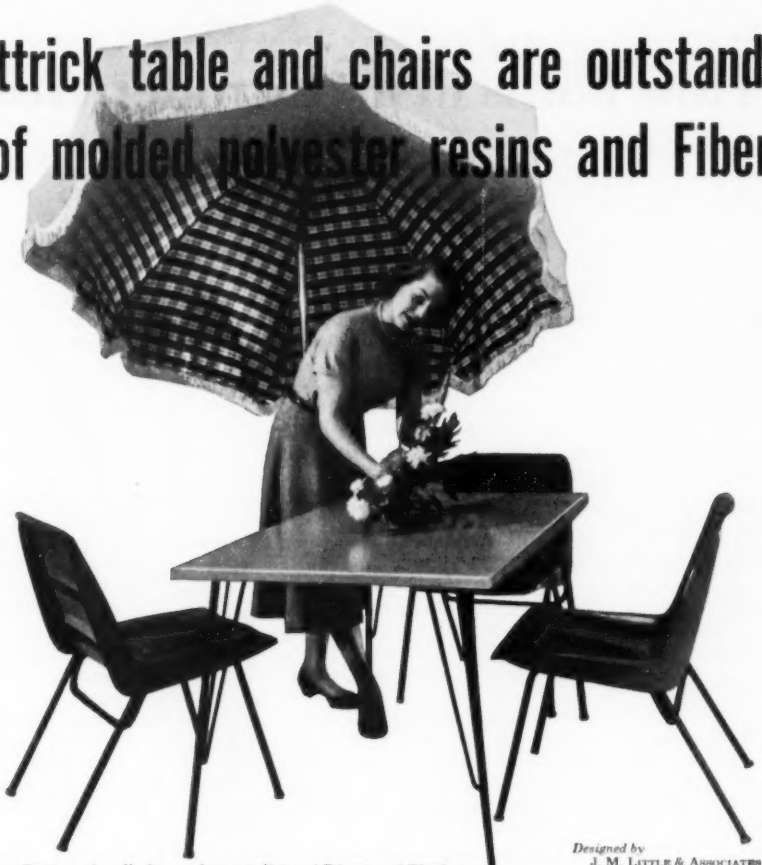

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Plastic Flow Paths in an Extruder Worm

by L. F. Street*

THE present discussion is directed to a determination of the main forces and lines of flow of material that is being advanced by an extruder worm under pressure. Quantitative analysis is not included.

In considering how material flows in an extruder worm we start from the fundamental action of the screw principle, as a screw advancing a nut when the screw is rotated and the nut held against rotation. Although this is the basic motivating force, when working with any plastic material there are modifications of this type of flow. Sometimes the modifying factors are slight, usually they are considerable.

Solid Flow

In pure solid flow, the entire mass of material acts as a unit, such as a nut on a bolt, without internal shear. When the material is held entirely without rotation, it advances one lead of the screw with each revolution of the screw. In an extruder, in order to prevent the material from rotating, pressure must be generated by the extruder worm to compact the material and press it against the casing. It is this pressing of the material against the casing that prevents the rotation of the mass of material. If all of the slip occurs at the surface of the worm, the material will advance without rotation as mentioned above, giving solid flow at 100% efficiency. No mixing of the material would occur in such an operation and the drive power would be absorbed in compressing the material, overcoming the surface friction as the worm turns past the material, overcoming the surface friction as it slides forward across the liner, and forcing the material out of the die.

In some cases, we obtain a condition which seems to be heavily dominated by solid flow. For example, in the extrusion of a carbon electrode a machine operates with a screw efficiency[1] of the order of 90%, which represents a high order of solid flow with most of the slip taking place at or near the surface of the worm.

If slip also occurs at the surface of the casing but without internal shear of the material, solid flow would result with an efficiency based on the differential between the two rates of slip. Since it is a given condition that we are dealing with a plastic material, the above condition is seldom even approached. To the extent that shear and rearrangement of the particles of material occur, we depart from solid flow.

Drag Flow

The next problem is that if there is slip or shear within the material, what is its character?

There is a tendency for material touching the stem of the worm to rotate with the worm while material touching the casing remains stationary. Thus, there is a tendency for planar shear at a graduated velocity from $V_c = O$ on the face of the casing to V_w = surface speed of worm, as shown in Fig. 1. Figure 2 shows the same effect in a flattened-out example. This we will refer to as drag flow. The rate of travel of the material would be along the line $V_c V_w$ for materials with uniform plastic flow. The average rotary rate of flow of the mass would equal one-half the speed of the worm.

If raised annular rings like flights occur periodically along the length, the material close to these rings or flights would get an additional rotary drag. Thus, the average speed of the mass will be somewhat greater than V_w. This is shown in Fig. 3, with average velocities being indicated.

It should be noted that this type of plastic flow produces no forward movement of the material, whereas solid flow always has some forward resultant except when all the slip occurs at the surface of the casing.

As shown in regard to drag flow, the particles near the surface of the

[1] As percent screw efficiency we take the actual volume delivered by the screw per turn divided by the volume that would be advanced by one turn of the last flight of the screw if there were no rotation.

* Welding Engineers, Inc.

FIG. 1
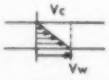
FIG. 2

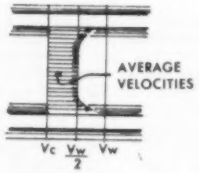

FIG. 3

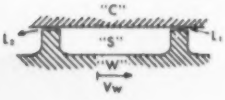

FIG. 4

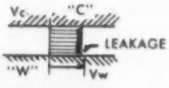

FIG. 5

FIG. 6

FIG. 7

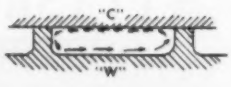

FIG. 8

FIG. 9

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Whirlaway Reel manufactured by Great Lakes Products, Inc., Detroit. Tenite parts molded by Mercury Plastics Company, Van Dyke, Mich.

casing will tend to be motionless as is the casing "C", while the material near the surface of the worm will move at the speed of the worm, as in Figs. 1 and 2. Now, let us assume that a flight exists parallel to the axis of the worm and is filled with plastic material, as shown in Fig. 4; we will also consider for the moment that the rotary motion is flattened out and the motion of the screw will be a sliding action at a velocity V_w normal to the surface of the flights, as shown in Fig. 4. The clearance between the land of the flight and the casing can be considered to be 0.002 in. or any usual amount. As the worm moves, the mass of material contained in space "S" moves along at the same speed as the worm except for that portion which leaks through the flight at L_2 and is replaced by material coming in at L_1. Thus, as we see illustrated in Fig. 5, the average velocity of the material is equal to the velocity of the worm less the leakage. Of course, in a circular cross section, the advance would equal the total represented by equal angular advance at all levels, as shown in Fig. 6.

Average Velocities

These illustrations represent the average velocities but do not represent the actual velocities occurring at each level. As a matter of fact, it would not be the same at all levels because the surface "C" is dragging against the material, whereas the surface "W" is traveling at the same speed as the average speed of the material, except for the differential introduced by the leakage. The slip will not all occur right at the surface of "C" but, on the contrary, the influence of the drag of "C" will be felt for some distance down into the material. Particles immediately against the surface of "C" will be stationary and the layers down from "C" gradually increasing in forward speed. The material against the surface of "W" will move with that surface. Since we know that the average speed of the mass and also the average velocity of the particles along any radial line is equal to V_w less leakage, the drag created by "C" must be compensated for by a greater forward velocity of the material at some part of the section. This might appear as illustrated in Fig. 7 or some other pattern, but it must conform to the requirement

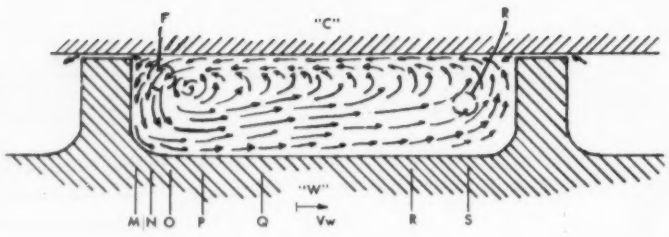

FIG. 10

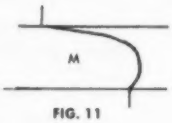

FIG. 11

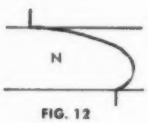

FIG. 12

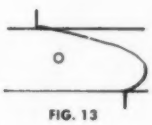

FIG. 13

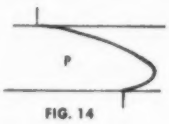

FIG. 14

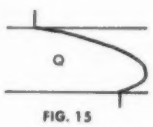

FIG. 15

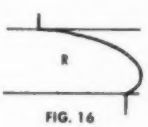

FIG. 16

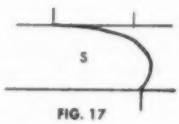

FIG. 17

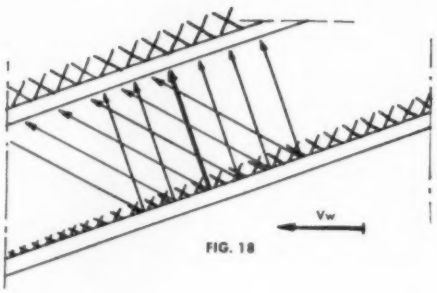

FIG. 18

that the average forward speed equals the velocity of "W" minus the leakage.

The change in the velocity condition from that shown in Fig. 2 to that shown in Fig. 7 is caused by the presence of the flight. Therefore, we may look to the flight for the source of the forces that produce this change and that produce a flow which for the moment we will assume to be something like that shown in Fig. 7.

As the flight moves across the surface of "C" it generates activity and pressure on the material much in the way a putty knife acts in scraping putty off glass. However, since the operation is confined, the material that would otherwise travel up the putty knife as it accumulated is forced to circulate around in the worm flight as shown in Fig. 8. The length of the arrows roughly indicates the speed of the particles in relation to $V_w/2 = O$, and the material next to the surface of "C" clinging to that surface. However, the material next to the surface of "W" will also cling to that surface, so the flow is modified as in Fig. 9. The highest rate of forward flow is toward the center of the section but closer to the worm as that surface has less speed differential with the material. Thus, we see that Fig. 7 is close to representing the actual flow. The exact form of the line will depend, among other things, on the plastic nature of the material and the forward speed required in the most rapidly moving particles.

A more detailed flow chart would probably look like that shown in Fig. 10 with velocities roughly related to $V_w/2 = O$. The probable cir-

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cumferential flows are charted in Figs. 11 to 17 on the section lines shown in Fig. 10. The source of the material moving forward rapidly at sections O, P, and Q is the downward flowing material at M and N. Further along the flight opening, material starts to flow upward and to remain stationary with the casing, which results in the flattening of the velocity line at R and S.

The presence of the flight pushing the material around with the worm generates a high pressure on the material that is being held relatively motionless near the surface of the casing. It is the existence of this high pressure zone that causes the material to flow away from the pushing face of the flight and across the flight opening to the rear face opposite. This, of course, is a pressure drop flow and would conform to the laws applicable to the materials being processed.

If the flights were turned at a slight angle instead of being parallel to the axis, circulating flow would still occur and an endwise flow would also occur. The direction of the material forced forward by the flight would be normal to the flight face and this would create the forward or endwise flow in addition to circumferential flow. As the flight is turned further, drag flow starts to have an influence, rotating the material next to the worm stem with the worm while the material near the surface of the casing has little circumferential motion as shown in Fig. 1. If the angle were increased, the influence of circulating flow would become less and the influence of drag flow would increase, until finally the condition illustrated in Figs. 1 and 3 would exist when the flights became annular rings.

Combined Circulating and Drag Flow

When a helical flight acts on a plastic material, circulating and drag flow act together. Circulating flow tends to act in a direction normal to the flight face. Drag flow influences the material at the same time with extra drag occurring on both sides of the flight, as illustrated in Fig. 3. Both of these actions derive from the drag that the casing exerts on the material,—circulating flow from the flight moving into the material held stationary by the casing, and drag flow from the shearing of the material between the stationary casing and moving worm stem.

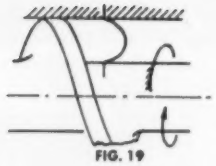
FIG. 19

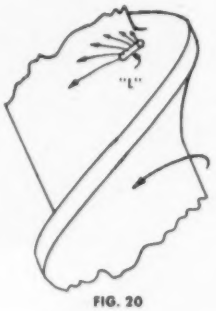

FIG. 20

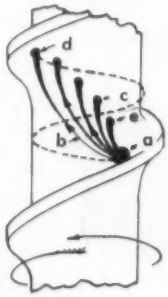

FIG. 21

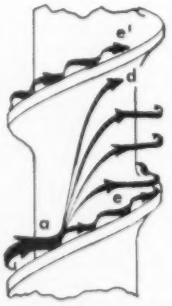

FIG. 22

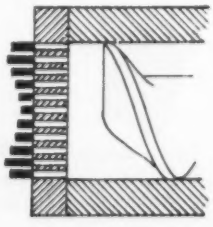
FIG. 23

The basis for the assumption that circulating flow tends to act normal to the flight face is shown in Fig. 18. A high pressure zone is present all the way along on the pushing face of the flight. Thus, the material will not flow sideways where no pressure drop exists but will flow across the opening in the direction of the heavy arrow to the low pressure area on the rear face of the opposite flight. However, pressures are greater toward the die as indicated by the increasing size of the X's and this will bring about some deflection of the flow lines. The greater the back pressure the more the deflection of the flow lines, and the more the flow lines are crowded together in contrast to the easiest line of flow, normal to the flight face. As these pressures mount, the material is pressed more firmly against the casing, resisting rotation and offering greater resistance to internal shear, thus countering the effect of the back pressure. This countering effect explains why many worms, particularly shallow flight worms, maintain a relatively uniform output over a wide range of back pressures.

Effect of Drag Flow

The normal quantitative effect of circulating flow for each turn of the screw is one flight spacing normal to the flight. The effect of drag flow must be taken into account to arrive at the actual flow.

Another way to conceive of this action is that the worm is advanced straight forward instead of rotating. In this case the direction of the circulating flow would be the same as illustrated, but now drag flow would decrease the deflection and bring about a combined result closer to straight forward flow.

In the extrusion operation the stem of the worm does not move in the direction in which the material is extruding; both the casing and the worm have no forward velocity. If the material slips on the casing, all the material rotates with the worm, but if the casing offers a drag on the material, as occurs in extrusion, the worm flight then drags across the edge of the material and advances it with the pushing action of an inclined plane. Thus, the forward motion of the material due to circulating flow would be modified as in

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Fig. 19. However, drag flow pulls the particles next to the worm around with the worm and the particles half-way between the worm stem and the casing rotate at half the lineal velocity of the worm stem. Thus, the curve shown in Fig. 19 would have its end next to the worm rotated with the worm and, viewed from either end, would appear as in Fig. 1.

It should be noted that in the cylindrical form existing in the extrusion operation, the effect of drag flow is less than in the flattened out representation of Fig. 2 because the stem of the worm is smaller in diameter than the path of the material and has a lower lineal velocity in relation to the material than in the flattened out representation. To put it another way we could say that the flight travels at a higher speed than the worm stem.

Flow Modified

It is also clear that any particles that have a combined rotary and forward speed less than that of the flight will be overtaken by the flight and given a forward thrust. Thus, the circulating flow illustrated in Figs. 10 to 17 will be modified by pulling the lower end of the curve back under the upper beginning point with the highest velocity in the center. This is the section taken normal to the flight face. We can now plot the path of the particles originating on a radial line "L" through the material held in the flight. Thus, we see that the particles at different levels are traveling in different directions, giving a twisting and smearing action as shown in Fig. 20. This represents a three dimensional graph looking like Fig. 1 when viewed along the axis and like Fig. 19 when viewed from the side.

In Fig. 21 is represented the path of particles in the worm flight space as the worm rotates. A supply of material "a" held stationary against the casing is scraped off by the worm flight. It sweeps down the flight, some particles traveling to the bottom of the flight and some going down only a short distance and then recirculating. A thin line in the illustration represents the path of a particle close to the worm stem and a heavy line, a path close to the casing. The actual rotary motion would be considerably greater than

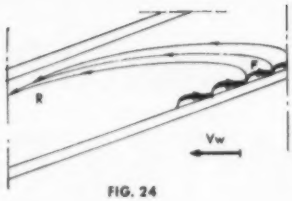

FIG. 24

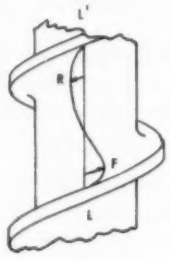

FIG. 25

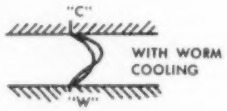

FIG. 26

FIG. 27

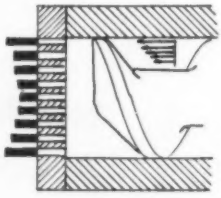
FIG. 28

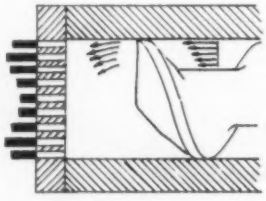
FIG. 29

that shown. The particle will arrive at "d" after the worm has made more than a complete turn before it rises against the casing; the true path of the particle as the worm turns is shown by the dotted line and the other paths will be in proportion. The particle will arrive at "e" meanwhile after only a small portion of a turn and will recirculate repeatedly as the worm flight catches up with it each time it rises against the casing. Of course, a particle may move in the path of "a" to "e", and then in its next cycle, move in the path of "a" to "d", and then follow an intermediate course. This action is taking place simultaneously at all points along the flight and throughout the mass of material. It should also be understood that few particles actually touch the casing; most of them are merely influenced by its drag as they get near the surface.

If we conceive of the worm as being stationary and the casing rotating, the path of the particles would be as represented in Fig. 22. Particles "e" and "d", which were adjacent at "a", after about two turns of the casing would be found at "d" and "e", being now on opposite sides of the flight. In this illustration the actual length of the various paths can be more readily represented.

The flow pattern illustrated in Fig. 10 is still the flow pattern taking place in a transverse section. In addition, though, the material is moving forward away from the viewer as it circulates from left to right.

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When the back pressure is just enough to keep the worm flights full, the flow will be as shown. Thus, we would expect an extrusion effi-

(*Continued on p. 200*)

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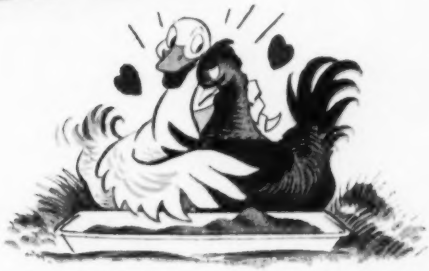

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PLASTICS DIGEST*

Abstracts from the world's literature of interest to those who make or use plastics or plastics products. Send requests for periodicals to the publishers listed.

General

FUTURE OF PLASTICS IN ENGINEERING. J. Gordon. Plastics (London) *17*, 344–5, 362 (Dec. 1952). The future of plastics in the changing picture of industrial engineering is discussed.

PHTHALIC ANHYDRIDE. J. E. Sayre. Chem. Eng. News *30*, 5138–42 (Dec. 8, 1952). The production and consumption of phthalic anhydride are surveyed.

HOW MUCH FORMALDEHYDE? Chem. Week *71*, 63–4, 66 (Nov. 22, 1952). The production and use of formaldehyde are surveyed.

Materials

CHLOROMETHYLATION OF POLYSTYRENE. G. D. Jones. Ind. Eng. Chem. *44*, 2686–93 (Nov. 1952). The chloromethylation of polystyrene was studied to determine the conversion which could be reached prior to insolubilization by cross linking. The soluble polymer isolated prior to this point was aminated with tertiary amines to produce a soluble, strong cationic polyelectrolyte. The product was water soluble if half of the benzene rings were thus substituted and soluble in aqueous acetone if only a third were substituted. The aminated products can be used as precipitants for polyfunctional acids or as mordants for acid dyes.

CARBOXYMETHYLCELLULOSE. R. N. Hader, W. F. Waldeck, and F. W. Smith. Ind. Eng. Chem. *44*, 2803–12 (Dec. 1952). A continuous process for the manufacturer of carboxymethylcellulose is described. Powdered wood cellulose is the primary starting material. The cellulose, a bleached sulfite pulp, is fed continuously to a large rotary reactor, where it is sprayed successively with solutions of caustic soda and monochloroacetic acid. The caustic converts the cellulose to the alkali form, with which the acid reacts to supply the carboxymethyl radical as a side chain. The final product, obtained as the sodium salt, is flash-dried. Of the three hydroxyls available for substitution in each unit of the cellulose chain, an average of 0.4 to 0.8 hydroxyl per unit is substituted, since this substitution range yields products with the most desirable chemical properties. By varying the degree of substitution, the amount of depolymerization of the cellulose chain, and the pH of the final product, it is possible to provide a wide range of properties. Carboxymethylcellulose can thus be tailor-made for optimum performance in any application in which it shows promise.

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Molding and Fabricating

FAULTS AND IRREGULARITIES IN INJECTION MOLDINGS.—I. W. M. Halliday. Plastics (London) *17*, 370–2 (Dec. 1952). The faults and irregularities occurring in the production of plastics injection moldings are classified under three headings: (1) Faults and errors affecting dimensional accuracy and uniformity of shape of the components; (2) defects and blemishes affecting surface finish and appearance of the components; and (3) irregularities affecting the physical properties of the components. The first of these points is discussed in detail.

LATEST DEVELOPMENTS IN HIGH SPEED AUTOMATIC MOLDING MACHINERY. F. C. Means. SPE J. *8*, 14–16 (Nov. 1952). Recent developments in high speed injection molding equipment are described.

LACQUERING POLYSTYRENE MOLDINGS. Brit. Plastics *25*, 418–19 (Dec. 1952). A procedure for applying a lacquer to polystyrene plastic moldings is described in detail. A coating of lacquer offers a means to give different colors, increase abrasion and chemical resistance, and reduce electrostatic dust attraction.

FAST-CYCLING MACHINE STEPS UP PRODUCTION. Brit. Plastics *25*, 406–8 (Dec. 1952). A new type of injection-cylinder assembly for an injection molding machine which can give 1200 shots per hour is described in detail.

VACUUM METALLIZING IN THE PLASTICS INDUSTRY. J. G. Seiter. SPE J. *8*, 12–13 (Oct. 1952). The commercial coating of plastics with metals by the vacuum deposition technique is described briefly. This method of metal coating is more economical than electroplating or chemical reduction techniques.

Applications

SYNTHETIC RESINS IN THE FOUNDRY. D. N. Buttrey. Brit. Plastics *25*, 410–15 (Dec. 1952). The use of synthetic resins in the production of foundry cores is reviewed. Urea, phenolic, and polyester resins are used to bind sand cores. The shell molding process utilizing phenolic resins is also described. 10 references.

GLASS-REINFORCED PLASTICS IN THE AIRCRAFT INDUSTRY. G. C. Hulbert. Plastics (London) *17*, 325–30 (Nov. 1952). The use of glass-reinforced plastics in the construction of British aircraft is described.

REACTIONS CATALYZED BY ANION EXCHANGE RESINS. M. J. Astle, J. A. Zaslowsky, and R. W. Etherington. Ind. Eng. Chem. *44*, 2867–72 (Dec. 1952). Weakly basic anion exchange resins are effective catalysts for the aldol condensation of aldehydes. The presence of organic acids does not decrease the catalytic activity of these resins. The aldol condensation of acetone and the cyanoethylation of alcohols can be catalyzed by strongly basic anion exchange resins. The activity of these resins can be destroyed by the presence of organic acids or the absorption of carbon dioxide from the air. Anion exchange resins are effective catalysts for base-catalyzed reactions. They have some advantages over conventional bases in that they can be removed from the reaction mixture by simple filtration and need not be neutralized at the end of the reaction. Continuous operation may be accomplished by passing the reactants through a column packed with a suitable ion exchange resin.

Properties

EFFECTS OF HUMIDITY DURING FABRICATION OF POLYESTER LAMINATES. J. E. Wier, D. C. Pons, and B. M. Axilrod. SPE J. *8*, 8–13, 27

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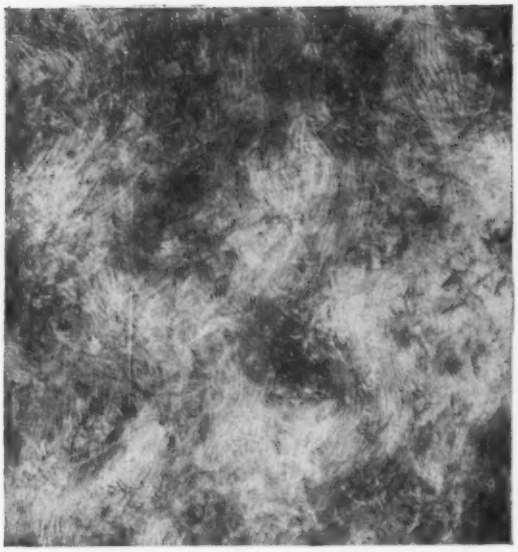

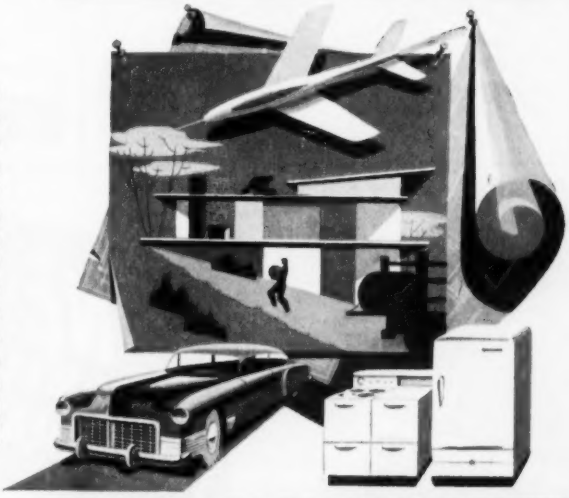

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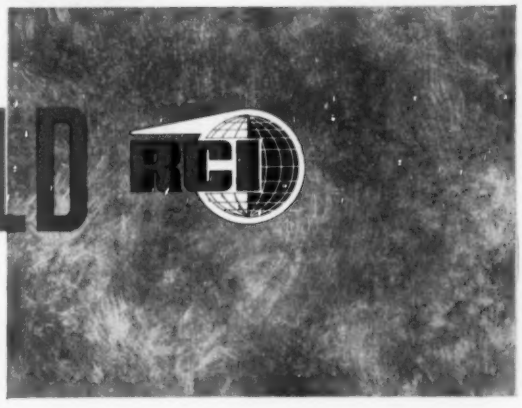

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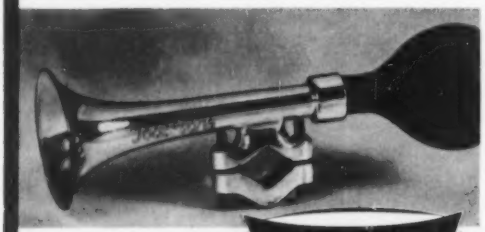

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(Nov. 1952). The effects of humidity during fabric conditioning and during fabrication upon some physical properties of laminates prepared with glass-fabric (Fiberglas 181–114) and an unsaturated-polyester resin (Laminac 4126) were investigated. Relative humidity during fabric conditioning and during fabrication was varied from about 4 to 95 percent. Molding pressures were 0.7 and 2.0 p.s.i. The molding temperature recommended by the manufacturer was 220° to 250° F. Preliminary experiments showed the following to be the best times for temperatures used: For 250°F., 2 hr.; for 220° F., 3 hr.; and for 160° F., 48 hr. Tests on these laminates included the measurement of flexural strength on the diagonal, both dry and after 7 days' immersion in water. specific gravity, resin content, percentage of voids, and total light transmission. Some data were also taken on lengthwise flexural strength. The effects of humidity during fabrication on flexural strength, both wet and dry, and on specific gravity, percentage of voids, and light transmission were pronounced when molding temperatures of 220° and 250° F. were used. At a molding temperature of 160° F. these effects were negligible. An increase in the humidity during fabrication decreased the flexural strength, the resin content, the specific gravity, and the light transmission, and increased the percentage of voids in laminates molded at 220° and 250° F. For example, when the relative humidity was increased from about 5 to 50% during resin coating, the flexural strengths, lengthwise and diagonal and wet or dry, decreased about 15 to 20% for laminates made using the 220° F. cure and about 35 to 40% for the 250° F. cure. Differences in the properties of laminates made of fabric which was dried over silica gel and those made of fabric which was oven-dried were negligible. A relationship was shown to exist between flexural strength and the percentage of voids, and between the percentage of voids and light transmission.

POLYMER DEGRADATION STUDIES BY ABSORPTION AND MASS SPECTROMETRY. B. G. Achhammer. Anal. Chem. *24*, 1925–30 (Dec. 1952). The use of absorption and mass spectrometry in a current study of polymer degradation mechanisms at the

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National Bureau of Standards is described. Infrared and ultraviolet spectrophotometry and mass spectrometry are discussed as tools for the determination of the chemical structure of polymers and for the detection of changes in the chemical structure of polymers which occur as a result of degradative treatment. Data obtained on specific polymers, including polystyrene, polyamides, and polyvinyl chloride, are presented to show how these techniques are applied to the determination of the composition of polymeric materials. Some limitations of absorption and mass spectrometric techniques for polymer studies are discussed.

Testing

PHYSICAL TESTING OF THERMOPLASTICS. J. J. Millane. Brit. Plastics *25*, 367-73 (Nov. 1952). Physical tests in common use provide only limited information about thermoplastic materials. This article points out difficulties in evaluating the physical properties of high polymers and explains the importance of carrying out tests over a wide range of time, temperature, and stress. The particular tests considered include impact, softening point, heat distortion, and flow.

DYE TEST FOR MELAMINE MOLDINGS. Plastics (London) *17*, 355–8 (Dec. 1952). A dye staining test for detecting the undercuring of melamine plastic moldings is described. This test can be used to determine the optimum degree of cure as well as local patches of insufficient cure caused by improper mold design or molding technique.

APPARATUS FOR PRODUCING HIGH HUMIDITY. J. A. Murray. ASTM Bulletin *1952*, No. 186, 47–8 (Dec. 1952). An apparatus for producing controlled high relative humidities is described.

TEST METHODS FOR PLASTICS. Modern Packaging *26*, 137–40 (Oct. 1952). Test methods are proposed by the Films and Foils Committee of the Packaging Institute for the conditioning and accelerated-age setting of plastics and plastic films. Both of the tests have been adapted from methods of the American Society for Testing Materials. Although they refer to molded plastic objects, they are equally applicable to plastic films.

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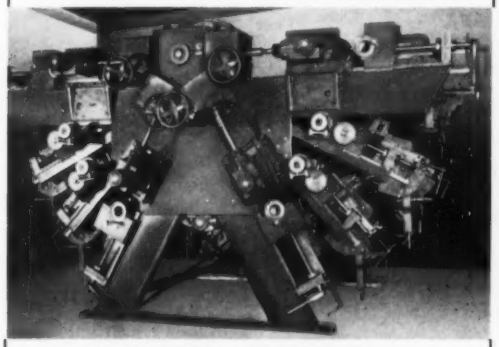

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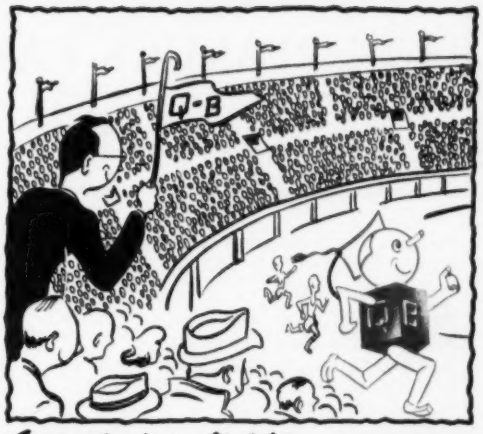

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U. S. PLASTICS PATENTS

Copies of these patents are available from the U. S. Patent Office, Washington, D. C., at 25¢ each.

RESIN. P. G. Schrader and A. M. Partansky (to Dow). U.S. 2,620,321, Dec. 2. Phenolic resins.

RESIN. G. L. Royer and C. A. Amick (to American Cyanamid). U.S. 2,620,322, Dec. 2. Solution of methylated methylolmelamine and triethanolamine silicofluoride.

POLYMERIZATION. H. W. Coover, Jr. and J. B. Dickey (to Eastman Kodak). U.S. 2,620,324, Dec. 2. Polymerization of acrylonitrile in the presence of polyamides.

POLYMERS. C. M. Langkammerer (to Du Pont). U.S. 2,620,325, Dec. 2. Polymeric oximes.

RESIN. J. Fautl (to Monsanto). U.S. 2,620,326, Dec. 2. Water-insoluble ammonium salt of sulfonated polystyrene.

RESINS. C. J. Albisetti (to Du Pont). U.S. 2,620,327, Dec. 2. Polyamides.

RESIN. R. R. Dreisbach (to Dow). U.S. 2,620,329, Dec. 2. Copolymer of 3,4-dimethylstyrene and p-chlorostyrene.

POLYMERIZATION. H. F. Park (to Monsanto). U.S. 2,620,330, Dec. 2. Polymerization of styrene with cyclic succinoyl peroxide.

POLYMERIZATION. R. C. Krug (to Atlantic Refining). U.S. 2,620,364, Dec. 2. Polymerization of olefins with boron phosphate catalyst.

RESIN. K. E. Muller (to Farbenfabriken Bayer). U.S. 2,620,516, Dec. 9. Reaction product of a diisocyanate and a polyester resin.

LAMINATES. B. Messing. U.S. 2,621,-138-9, Dec. 9. Forming laminated quilted thermoplastic laminates.

EXPANDED PLASTICS. L. C. Kulp, E. C. Van Buskirk, and B. A. Hunter (to U. S. Rubber). U.S. 2,621,161, Dec. 9. Gas-expanded plastics.

RESINS. L. H. Brown (to California Research). U.S. 2,621,165, Dec. 9. Phenol phthalaldehyde resins.

RESINS. F. W. Schmidt and K. E. Muller (to Farbenfabriken Bayer). U.S. 2,621,166, Dec. 9. Reaction product of an elastomer and an isocyanate modified polyester.

RESINS. J. W. Fisher and J. L. London (to Celanese). U.S. 2,621,167, Dec. 9. Trans-quinitol-succinic acid polyesters.

RESINS. S. D. Ross and M. Markavian (to Sprague Electric). U.S. 2,621,168, Dec. 9. Condensates of halogenated aromatic compounds.

RESINS SALTS. H. Robineete, Jr., and C. W. Pfeifer (to Publicker). U.S. 2,621,169, Dec. 9. Ammonium salts of acidic copolymers.

COPOLYMERS. F. W. Banes and J. D. Garber (to Standard Oil). U.S. 2,621,170, Dec. 9. Ductile acrylonitrile copolymers.

POLYMERIZATION. G. D. Jones (to Dow). U.S. 2,621,171, Dec. 9. Polymerization of alpha-methyl-styrene.

POLYMERS. K. M. Gaver, E. P. Lasure, and L. M. Thomas (to Keever Starch). U.S. 2,621,174, Dec. 9. Amino derivatives of glucopyranose polymers.

MOLDING. N. Fienberg and A. R. Calder (to A.C.I. Plastics). U.S. 2,621-363, Dec 16. Plastic molding machine.

HEAT SEALING. N. Langer. U.S. 2,621,704, Dec. 16. Machine for heat sealing thermoplastic sheets.

ACRYLONITRILE. H. M. Hoxie (to American Viscose). U.S. 2,622,003, Dec. 16. Shaped articles of acrylonitrile.

ADHESIVE. R. A. DeCoudres and C. S. Myers (to Carbide and Carbon). U.S. 2,622,056, Dec. 16. Polyethylene polymerized in a chlorinated solvent.

RESINS. F. M. Vialatout (to L'Auxiliare des Chemins de Fer). U.S. 2,622,064, Dec. 16. Copolymerizate of cyanoguanidine, formaldehyde, and nitroguanidine.

POLYMERS. H. W. Coover, Jr. and J. B. Dickey (to Eastman Kodak). U.S. 2,622,074, Dec. 16. Polymers of salts of alpha-acylamido and alpha-alkoxycarbonamido acrylic acids.

RESINS. H. M. Hemmi and P. Trefzer (to Sandoz). U.S. 2,622,075, Dec. 16. Polyamine-cyanamide resins.

POLYMERS. T. Koch (to N. V. Onderzoekingsintituut Research). U.S. 2,622,076, Dec. 16. Linear macromolecular aminoacid-polycondensates from lactams.

POLYMERIZATION. H. F. Park and H. A. Walter (to Monsanto). U.S. 2,622,077, Dec. 16. Polymerization of styrene in the presence of pinacolone peroxide.

CELLULOSE ESTERS. C. L. Crane (to Eastman Kodak). U.S. 2,622,079, Dec. 16. Cellulose acetate-sulfate.

CELLULOSE ESTERS. G. A. Richter, E. L. Perkins and L. E. Herdle (to Eastman Kodak). U.S. 2,622,080, Dec. 16. High butyryl cellulose esters.

MOLDING. A. N. Gray (to Western Electric). U.S. 2,622,469, Dec. 23. Apparatus for controlling temperature of plastic in an extrusion machine.

PAPER TREATING. G. I. Keim (to Hercules). U.S. 2,622,979, Dec. 23. Paper containing a lignin sulfonate-modified urea-formaldehyde resin.

FABRIC TREATMENT. A. L. Lippert and W. P. Hall (to Joseph Bancroft and Sons). U.S. 2,622,995, Dec. 23. Process for resin-impregnating cellulosic fabrics.

FELT TREATMENT. O. P. Cohen (to Monsanto). U.S. 2,622,996, Dec. 23. Treatment of felts with thermosetting resins.

COATINGS. J. Lolkema and P. J. A. Beersma (to Naamlooze Vennootshap). U.S. 2,622,997, Dec. 23. Forming coatings of ferric compounds of cellulose ether carboxylic acids.

ION EXCHANGE. G. F. D'Alelio (to Koppers). U.S. 2,623,013, Dec. 23. Ion exchange resins from vinyl pyridine or vinyl quinoline and a vinyl ethinyl hydrocarbon.

CELLULAR RESINS. J. E. Koroly (to Rohm and Haas). U.S. 2,623,023, Dec. 23. Expanded resinous products containing polyepoxides and aconitic acid.

RESINS. W. C. Dearing and A. M.

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Howald (to Libbey-Owens-Ford). U.S. 2,623,025, Dec. 23. Stabilizing polyester resins.

COATING. T. J. Bagley (to Hollingshead). U.S. 2,623,026, Dec. 23. Coating containing shellac, terpene phenolic, and a synthetic rubber.

SEALER. G. L. Deniston and O. W. Berglund (to Chadeloid). U.S. 2,623,027, Dec. 23. Composition of phenolic alkyd resin, alkyd resin, and urea-formaldehyde resin.

COLORING. B. Love (to Libbey-Owens-Ford). U.S. 2,623,028, Dec. 23. Coloring amine-aldehyde resin molding compositions.

RESINS. W. C. Dearing and A. M. Howald (to Libbey-Owens-Ford). U.S. 2,623,029, Dec. 23. Polyester resin containing stabilizing filler.

RESIN. D. E. Cordier (to Libbey-Owens-Ford). U.S. 2,623,030, Dec. 23. Metallic stabilizer for alkyd resin.

COPOLYESTERS. M. D. Snyder (to Du Pont). U.S. 2,623,031, Dec. 23. Elastic linear copolyesters.

POLYMERIZATION. F. W. Banes and E. Arundale (to Standard Oil). U.S. 2,623, 032, Dec. 23. Two-stage emulsion polymerization.

COPOLYESTERS. M. D. Snyder (to Du Pont). U.S. 2,623,033, Dec. 23. Elastic copolyesters.

POLYMER. P. J. Flory and F. S. Leutner (to Wingfoot). U.S. 2,623,034, Dec. 23. Tetramethylene isophthalate polymer.

RESIN. J. W. Schappel (to American Viscose). U.S. 2,623,035, Dec. 23. Addition products of an amine and sulfone-activated ethylenic compound.

COPOLYMERS. H. T. Neher, W. L. Van Horn, and L. N. Bauer (to Rohm and Haas). U.S. 2,623,036, Dec. 23. Acrylate-maleate copolymers.

RESINS. R. V. Jones (to Phillips Petroleum). U.S. 2,623,037, Dec. 23. Sulfonating polyvinyl alcohol.

RESIN. E. Frankl (to Rochester Button). U.S. 2,623,039, Dec. 23. Thermosetting keratinoid composition.

CELLULOSE DERIVATIVES. V. R. Grassie and C. L. P. Vaughan (to Hercules). U.S. 2,623,041-2, Dec. 23. Dialkyl aminoalkyl ethers of cellulose.

TEXTILE TREATMENT. J. W. Schap-

pel (to American Viscose). U.S. 2,623,807, Dec. 30. Textiles reacted with urea-vinyl sulfone addition products.

POLYMERIZATION. C. A. Mackenzie and M. Schoffman (to Montclair Research and Ellis-Foster). U.S. 2,623,832, Dec. 30. Method of condensing silicon acylates.

RESINS. J. R. Dieckmann, L. W. Muscott and A. F. Roche (to Dow). U.S. 2,623,863, Dec. 30. Blending resins with rubbers.

POLYMERIZATION. A. N. Wrigley, E. Yanovsky, and P. L. Nichols, Jr. (to U.S.). U.S. 2,623,864, Dec. 30. Polymerization of allylic ethers.

PHENOLIC RESINS. K. Dietz (to Farbwerke Hoechst). U.S. 2,623,865, Dec. 30. Low temperature setting resins.

RESINS. S. B. Twiss and A. P. Sporzynski (to Chrysler). U.S. 2,623,866, Dec. 30. Phenyl borate-aldehyde resin.

RESINS. H. Dreyfus (to Celanese). U.S. 2,623,867, Dec. 30. Polyurea-urethanes.

RESINS. F. G. Kleinschrod and J. W. Fisher (to British Celanese). U.S. 2,623,868-9, Dec. 30. Linear-poly-4-amino-1,2,4-triazoles.

HOLLOW ARTICLES. C. Delacoste and Y. Cornic (to Vinyl Cast). U.S. 2,624,072, Jan. 6. Hollow plastic articles.

HOSE. W. J. Pugh. U.S. 2,624,073, Jan. 6. Extrusion molding of plastic hose.

HOSE. W. J. Pugh. U.S. 2,624,366, Jan. 6. Plastic coated rubber hose.

MOLDING POWDER. V. J. Wilhousky (to American Cyanamid). U.S. 2,624,514, Jan. 6. Grinding of thermosetting aminoplastic powder.

PLASTIC. D. Swern (to U.S.). U.S. 2,624,680, Jan. 6. Plastic plasticized with alkyl alkoxy hydroxy stearates.

FLOOR COVER. J. E. Hazeltine, Jr. (to Armstrong Cork). U.S. 2,624,682, Jan. 6. Plastic felt floor covering.

PAPER TREATMENT. J. Kamlet (to Mathieson). U.S. 2,624,686, Jan. 6. Resin for high wet strength paper.

POLYESTERS. M. H. Bigelow (to Libbey-Owens-Ford). U.S. 2,624,714, Jan. 6. Polyester composition containing graphite, glass fiber fillers.

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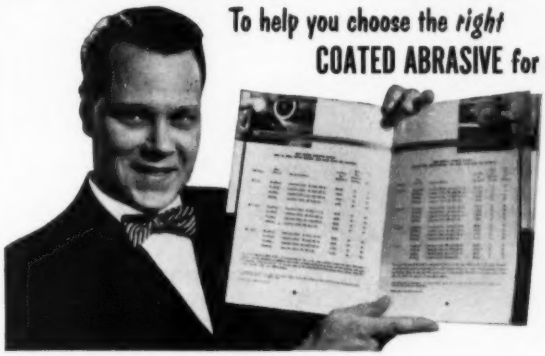

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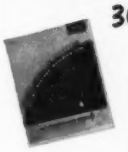

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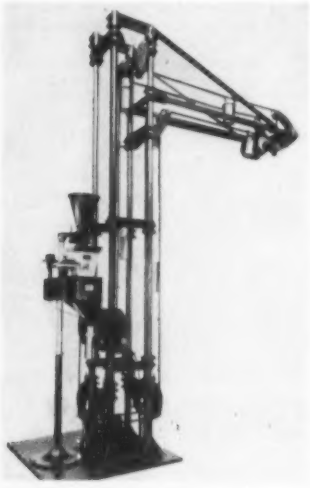
NEW MACHINERY AND EQUIPMENT

UNIT WEIGHT CONVEYOR—Designed for installation alongside any size molding machine, a new unit weight conveyor has been developed for the plastics molding industry by B. F. Gump Co., 1313 So. Cicero Ave., Chicago 50, Ill. The conveyor automatically feeds accurate unit weights to the cavity of the molding machine, providing the advantages of weight feeding in installations where it is impractical to install the weigher directly above the molding machine. The unit consists of a frame supporting a conveyor chain on which stainless steel buckets are mounted. The standard model is equipped with six buckets.

An automatic net weigher is an integral part of the unit weight con-



veying system. The weigher can be set to discharge the exact weight required for each mold. It automatically fills three buckets with this unit weight. The buckets are moved vertically to the height of the molding machine, then horizontally until the first filled bucket is in position over the molding machine hopper. Here it is stopped until action of the molding machine activates the control circuit which allows it to dump into the mold cavity. At the same time, one additional bucket receives a weight charge from the weigher. This cycle repeats automatically each time the molding machine is ready for another charge.

AUTOMATIC MASK WASHER—An automatic mask washer for spray painting masks and adjustable clamping fixtures for spray masks have been announced by Finish Engineering Co., Inc., 1115 Cherry St., Erie, Pa. The circulator in the automatic mask washer has no critical dimensions which can change operating efficiency due to abrasion of paint solids. The electric motor and switch are explosion-proof, class 1 group D. Accumulated paint solids may be removed, after the machine is idle for a few hours, by removing the sludge pan and scraping off the solids. Required floor space is 25 by 46 inches. Solvent capacity is 45 gallons.

The clamping fixtures for spray masks are easily adjustable to hold various sizes of masks. The pistons which apply pressure where it is needed may be moved laterally, vertically, forward, or backward. Clamping and releasing are controlled by a foot pedal. Air action is regulated so that forward action of pistons is a controlled steady motion rather than an impact. Releasing action is immediate. Solvent resistant hose is used for air supply to prevent deterioration due to action of paint spray. Structural members are of steel; all surfaces and parts are nickel plated.

ELECTRIC VALVES—Solenoid electric high pressure valves, suitable for any application where the medium is not harmful to bronze or stainless steel, are being manufactured by Atkomatic Valve Co., Dept. 189, 545 Abbott St., Indianapolis 25, Ind. Coil housings for various conditions are offered in dust-tight, water-tight, or explosion-proof housings for use in hazardous atmospheres. The valves are made in sizes from ½ to 1½ in., and for pressures to 3000 p.s.i. Designed with only 3 moving parts and no external linkage, normal valve maintenance is further reduced by the packless construction incorporated in the design.

EXTRUSION ACCESSORIES—A new line of conveyors, cooling tanks, dies, and special accessories for the plastics extrusion industry is announced by Robbins Tool & Die Co., 519 Maple Row, Elkhart, Ind. The model R-611 conveyor is of rigid construction to allow embossing, pinking, or slitting machines to be easily fastened to the front of the conveyor, eliminating secondary operation. (The conveyor can be constructed with or without this feature.) The unit has been designed with two extra rolls in the water tank. Material can be run over the belt, down through the water tank, and back over the belt as many times as needed for efficient cooling. The conveyor takes any width of belt, and is of all-welded construction.

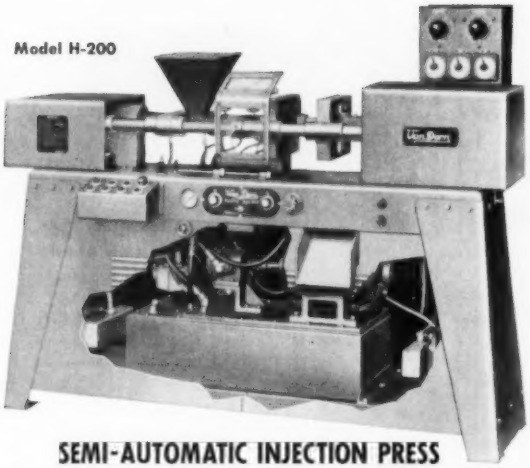
Another recent product is the model R-500 cooling tank, which has adjustable height, a splash pan with drain, a tank which converts into a rack for handling ridged material and which rolls on ball bearing casters.

CUBE CUTTING GRANULATOR—Produced by L. F. Bas et Cie., France, and distributed by Industrial Plastics Ltd., 16-17 Jermyn St., London S.W.1, England, the Girovinyle granulator is designed for the production of the following cube-cut compounds: P.V.C., polyethylene, cellulose acetate, nylon and other polyamides, cellulose acetate butyrate, natural and synthetic rubber, and, under certain conditions, polystyrene and ethyl cellulose.

It is the claim of the manufacturer that the granulator will produce uniform cubes of the desired size, with smooth edges and without the material having been affected by heat during the granulating process.

The granulator consists of two serrated rollers mounted with circular knives. The circular knives of the top roller work between the edges of the circular knives of the bottom roller with minimum clearance. The

Model H-200



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2-oz. capacity. Van Dorn's engineering experience has scored again with this leader among all injection presses of its class. Its ultra-modern design insures faster operating cycles—up to 6 per minute. Push button controls are safe, simple and convenient. Accurate temperature regulation. Ruggedly built, compact and quiet.

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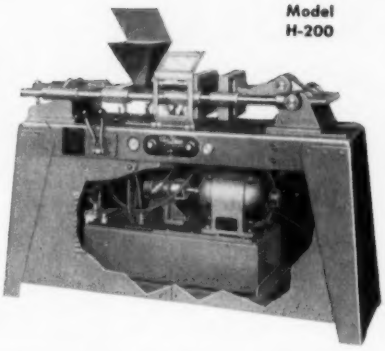

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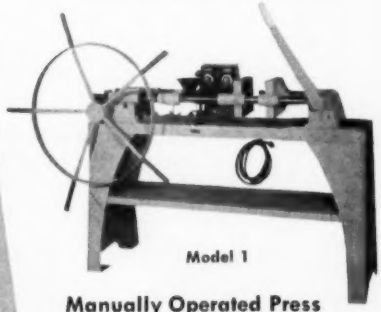

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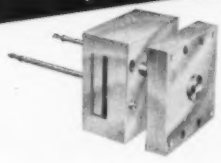

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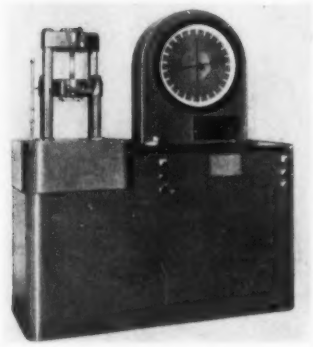
Three models of the granulator are available, and the rate of cube production is different for each. The range extends from 441 pounds to over 2270 pounds per hour.

UNIVERSAL TESTING MACHINES—Three major changes in the new models of Baldwin 60-H and 12-H universal testing machines are: 1) increase in clear space between columns from 10 to 15 in.; 2) single, rather than two-unit design; and 3) choice of 2 types of Emery dials indicators. Loading speeds can be continuously varied between 0 and 2 in. per minute on the 60-H and between 0 and



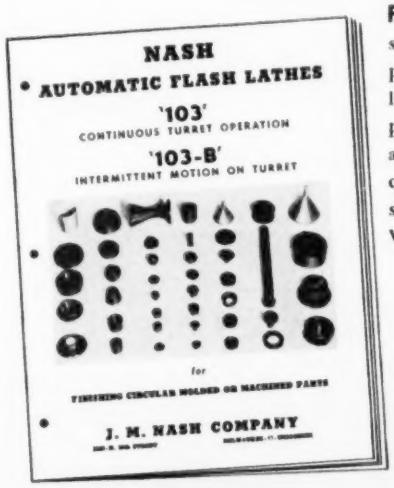
4 in. per minute on the 12-H. The machines, produced by the Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa., have standard lower ranges, with Emery gage load indicators having 600 graduations, of 0 to 3000 lb. on the 12-H and 0 to 12,000 on the 60-H. Both machines are 67½ in. wide, 27 in. deep overall, and have a height of 77½ in. over the indicator.

PRESSURE JOINT—Conveying steam under pressures up to 350 p.s.i. and liquids under pressures up to 3500 p.s.i., while rotating at high speeds, the rotary pressure joint produced

CUT TIME and LABOR COSTS with NASH

AUTOMATIC FLASH LATHES

Continuous or Intermittent Turret Operation



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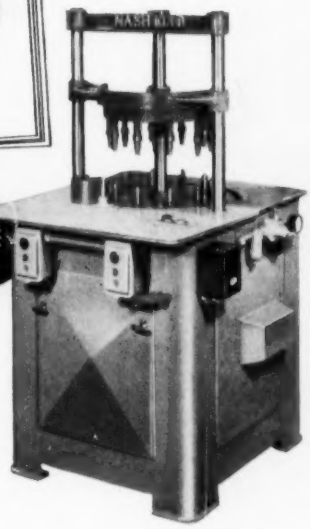
NASH 103-B AUTOMATIC FLASH LATHE with Intermittent Motion on Turret



The Nash No. 103-B is a *Ten-Spindle Controlled Index Machine.* It provides independent selection of proper feed and spindle speed . . . also control of speed of turret travel to the dwell position and period of time during dwell. Movement of stations is air-powered, hydraulically checked and electrically controlled.

A variety of tooling can be mounted on back table which has three outlets for motor connection. Tooling can consist of Buffing Wheels, Abrasive or Buffing Belts, Crimping Rollers, Revolving Knives for height trimming, Grooving Knives, Grinding Wheel, etc.

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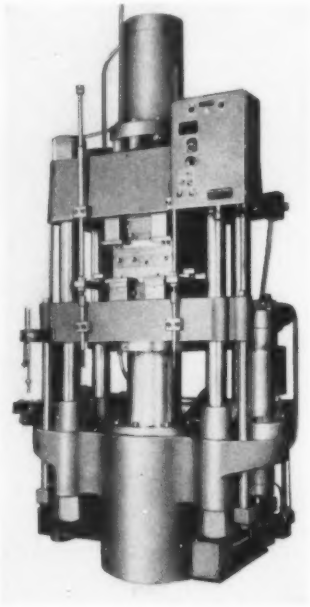

stroke, top or bottom transfer, and semi-automatic pressure controls. Pressure range, designed primarily for plastic and rubber molding, is from 20 to 400 tons, but may be adapted for more wide-spread industrial use.

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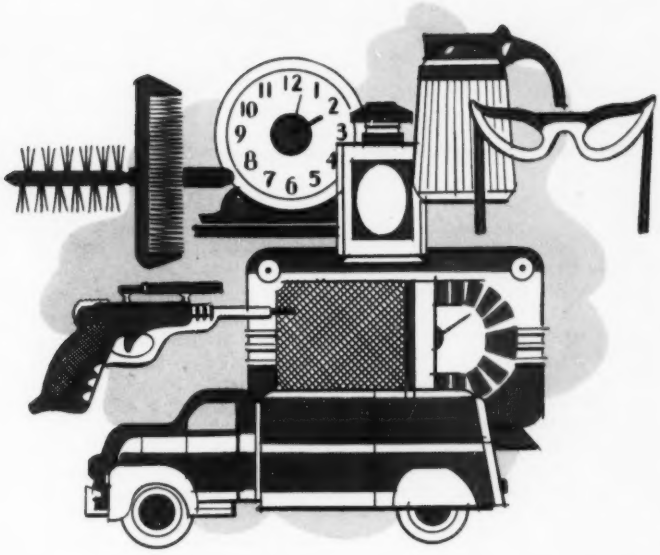

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BOOKS AND BOOKLETS

Write for these publications to the companies listed. Unless otherwise specified, they will be sent gratis to executives who request them on business stationery.

"Rubber Trade Directory of Great Britain."

Published in 1953 by MacLaren & Sons, Ltd., Stafford House, London W. C. 2, England. Produced by the editorial staff of *India-Rubber Journal*. 856 pages. Price $9.00

Enlarged by over 100 pages and brought up to date, the 1952-53 edition of this directory provides a reference guide to all sections of the British rubber industry. It is fully classified, and the arrangement is alphabetical throughout. A new feature of this latest edition is a firms' names index which provides the correct name, address, and telephone number of every concern listed in the directory.

"Radioisotopes in Industry," edited by John R. Bradford.

Published in 1953 by Reinhold Publishing Corp., 330 W. 42nd St., New York 36, N. Y. 309 pages. Price $8.00

Industrial uses of radioisotopes have assumed increasing importance over the past few years. The present volume, based on a series of lectures presented at Case Institute of Technology, is an effort to summarize developments and bring them up to date. From an examination of the numerous application possibilities of radioisotopes in industry—such as following the flow of a liquid through a pipe, tracing atomic and molecular structures, developing analytical shortcuts, to name just a few examples—the book proceeds to cover such topics as methods of radiation protection, waste disposal, makeup of radiochemical laboratories, instrumentation of such laboratories, and others. Although there is a certain amount of mathematical treatment to be found in this work, it has been kept to a bare minimum. At the same time the book contains a considerable number of schematic, diagrammatic, and photographic illustrations, all of which contribute to an easier understanding of this subject, making it of value to both managerial and technical personnel.

Acrylic resin—Entitled "How to Work With Plexiglas," this 20-page booklet gives directions for cutting and machining, punching and drilling, sawing, routing and shaping, turning, scraping, sanding, buffing, and joining the product. Blow and vacuum forming methods are also described. *Cadillac Plastic Co., 15111 Second Ave., Detroit 3, Mich.*

Acetone—General information, together with physical properties and specifications, of the company's acetone are given in this 4-page technical data sheet. Also listed are some of the common chemical reactions of acetone, together with information as to its toxicity, shipping, handling, and storage. *Commercial Solvents Corp., 260 Madison Ave., New York 16, N. Y.*

Trade film—"Small Business and the Air Force" is the title of a motion picture produced for the Air Force and designed to show small businessmen how to seek Air Force business with a minimum of time, money, and effort. This 22-min. sound film will be shown to small businessmen and coupled with the appearance of a specialist to answer queries and offer information to potential Air Force suppliers. Information on the film is obtainable from *Eastern Air Procurement District, Air Materiel Command, 655 Madison Ave., New York 21, N. Y.*

Testing—Eighty different methods for testing, inspecting, and analyzing some ninety different types of products are listed in this 4-page booklet, designed to demonstrate to industry and business the scope of services available to them for the quality control of many products. Included are non-destructive testing; testing for performance, corrosion resistance, and surface protection; and chemical analysis. Also covered are development of specifications; product certification; and the Seal of Approval. *American Standards Testing Bureau, Inc., 44 Trinity Pl., New York 6, N. Y.*

Market trends—A detailed analysis of market trends in the United States coupled with a review of available sources of market data, has been distributed to members of the Institute. For information write *Research Institute of America, Inc., 292 Madison Ave., New York 17, N. Y.*

Aliphatic nitrogen compounds—Thirty-five aliphatic nitrogen compounds are described in detail in this 44-page illustrated booklet. Physical properties, specifications, and shipping data are included. The booklet also lists 18 amines that are available in research quantities and gives their suggested uses. A feature of the booklet is a section devoted to the specification test methods used by the company for its aliphatic nitrogen compounds. A comprehensive bibliography is presented. *Carbide and Carbon Chemicals Co., 30 E. 42 St., New York 17, N. Y.*

Radiant heating panels—Twenty-four separate items covering component parts and characteristics are described in a 4-page folder of specifications of far-infrared radiant panels. Dimensions of the panel are shown in a drawing. *Edwin L. Wiegand Co., 7500 Thomas Blvd., Pittsburgh 8, Pa.*

Molded nylon parts—Custom molded nylon plastics parts are described in this 4-page illustrated bulletin. More than 20 parts are illustrated, and their mechanical applications and design possibilities are given. Text contains an appraisal of nylon's strength, weight, and self-lubrication characteristics. Tables are included which show mechanical, thermal, electrical, and other properties of molded nylon. *General Electric Co., Chemical Div., Pittsfield, Mass.*

Demineralization—Demineralization of water and silica removal through the medium of ion exchange resins are explained and discussed in this 28-page illustrated bulletin. Bulletin 3803 describes the chief applications, principles of operation, design features, advantages, recommendations, and specifications of demineralizing

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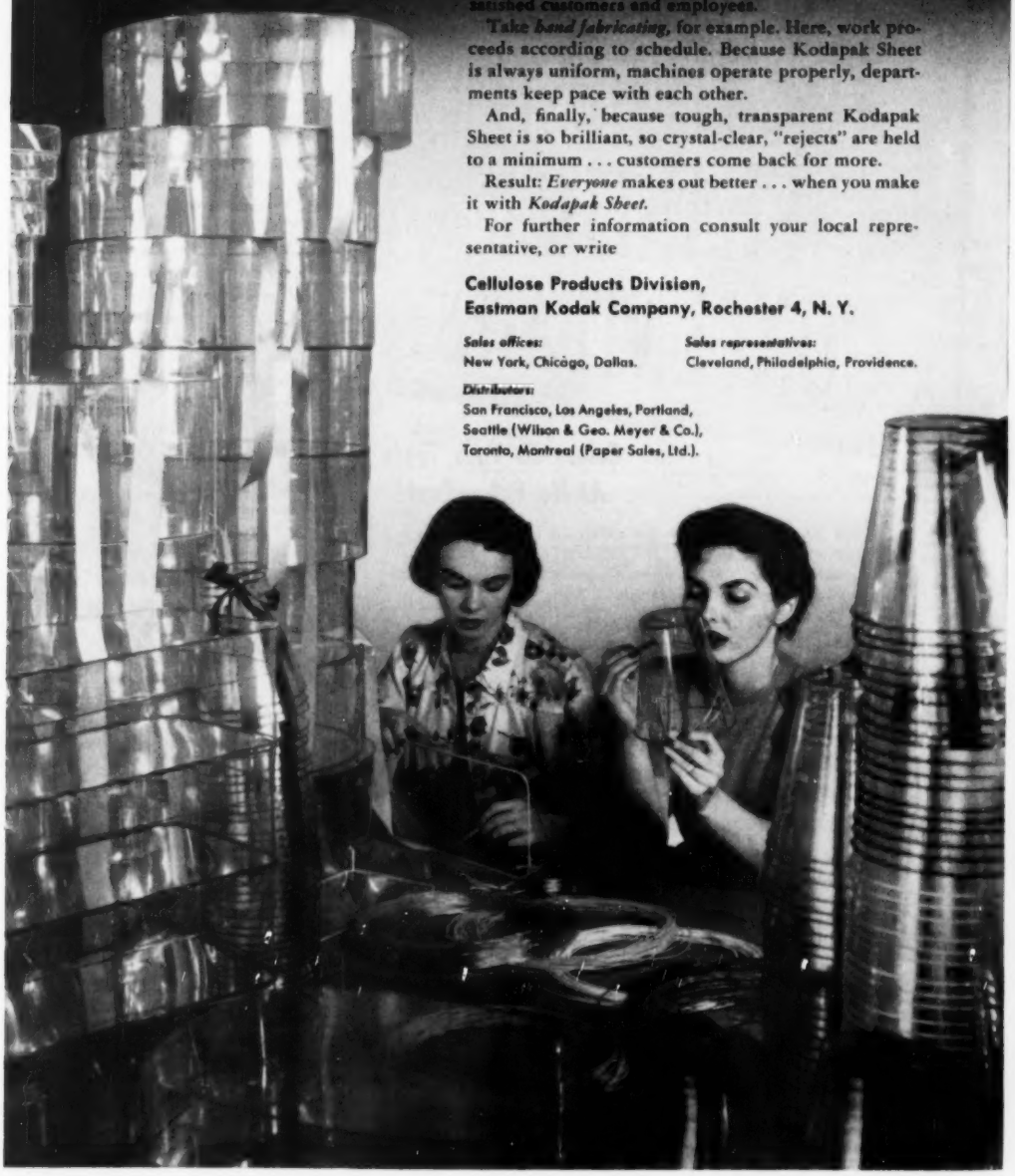

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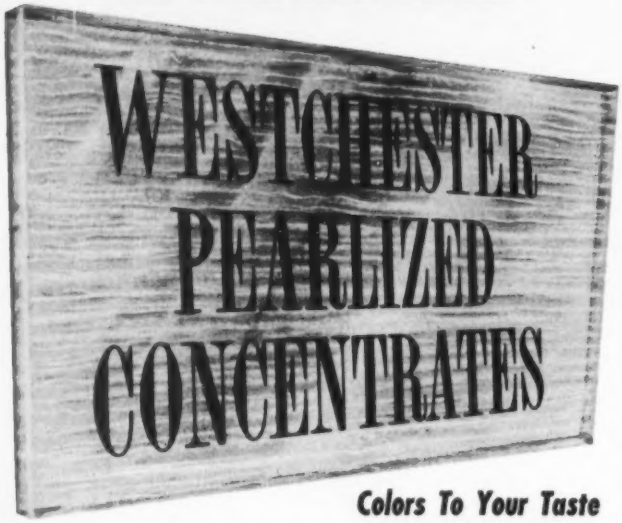

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Custom Compounders of Thermoplastic Materials

and silica removal apparatus and synthetic resins for industrial water treatment. *The Permutit Co., 330 W. 42 St., New York 36, N.Y.*

Concrete—The theory and practice of obtaining satisfactory concrete is the subject of an 8-page booklet, "Plastiment Concrete Densifier." It discusses the various factors affecting cement hydration and basic quality of concrete, and how these factors can be controlled to reduce cracking and increase concrete hardness and impermeability through the use of a special organic salt. *Sika Chemical Corp., 35 Gregory Ave., Passaic, N. J.*

Perspective drawings—Based on experience gained through active participation in various technical fields, "How to Prepare Perspective Drawings for Training Literature" suggests and illustrates ways and means by which perspective drawings can be of direct benefit to the manufacturer—from the engineering department right down through the production line. While the subject matter of this booklet is a basic requirement on all military contracts, use of the same type of drawing has also been shown to be commercially profitable. *TM Publishers, Inc., Room 300, 936 N. Michigan Ave., Chicago, Ill.*

Persulfates—Bulletin No. 34 represents a collection of literature references pertaining to various uses of persulfates. These references cover the period from 1907 to 1950, mostly taken from "Chemical Abstracts." Among the fields discussed are biological chemistry, cellulose chemistry, fur bleaching, polymerization, textiles, organics, and the rubber industry. Approximately 100 references are cited. *Buffalo Electro-Chemical Co., Inc., Station B, Buffalo 7, N. Y.*

Patents—The Winter 1953 edition of "Chemonomics" discusses highlights of the newly revised U. S. patent law. Other topics covered in this edition are nonionic detergents and fiber developments abroad. *R. S. Aries & Associates, 400 Madison Ave., New York 17, N. Y.*

Surface coating—Latest technical information on specifications, formulations, and uses of Vinylite resin

VMCH as a surface coating has been published in Technical Release #12. This 16-page booklet covers such subjects as the effect of addition of plasticizers, stabilizers, and solvents on resin VMCH, the proper method of selecting and using pigments, and the use of VMCH as blending agent for improved adhesion characteristics. Several applications of the resin are listed. *Don Mason. Bakelite Co., Div. of Union Carbide and Carbon Corp., 300 Madison Ave., New York 17, N.Y.*

Stabilizer—Properties and uses of the company's stabilizer #90 are covered in this 4-page technical report. Full data are given on chemical and physical properties of the compound, with particular stress placed on an examination of the non-toxic properties of the stabilizer. *Witco Chemical Co., 260 Madison Ave., New York 16, N.Y.*

Safety films—Accidents, their causes and prevention, is the subject of two recently released safety films. "Pick Your Safety Target," an all-color cartoon film, outlines a three-step plan for the detection of accident causes and presents lines of corrective action to be taken. This film is available in 35mm sound slide (color) and 16mm sound motion picture (color and black & white). The second film, "A Gray Day for O'Grady," employs a series of comedy situations to dramatize the high cost of accidents. It is available in 35mm sound slidefilm (black & white) and 16mm sound motion picture (black & white). For additional information and prices write *National Safety Council, 425 N. Michigan Ave., Chicago 11, Ill.*

Graphic instruments—Containing application notes, this 16-page booklet entitled "Solving Industrial Crimes" illustrates how various industries have employed graphic instruments to check on the status and progress of their production work. *The Esterlin-Angus Co., Inc., P.O. Box 596, Indianapolis 6, Ind.*

Odors—Catalogue No. 2 lists information on odors for industry as well as germicides and fungicides, stabilizers and anti-oxidants, and anti-skinning agents. The 20-page brochure lists various deodorants and reodorants according to the indus-

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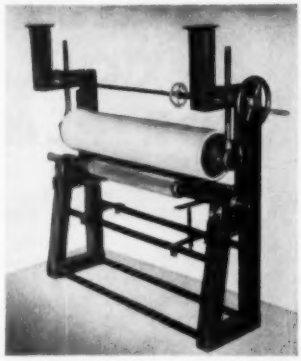

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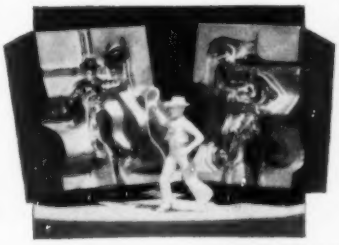

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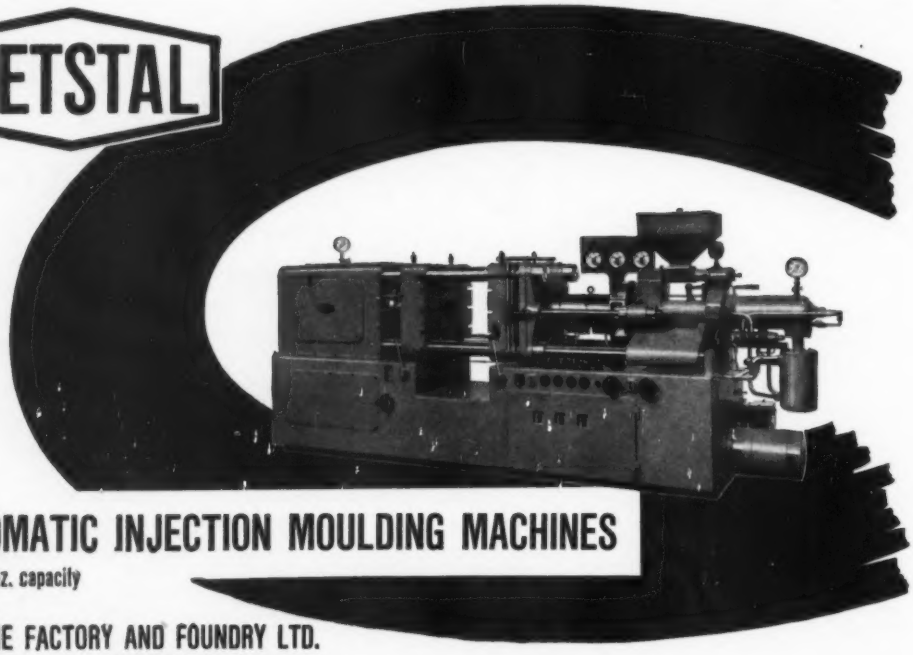

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trial commodities for which they are suitable, such as paint, rubber, glues, plastics, and others. Technical references are included. *Sindar Corp., 330 West 42 St., New York 36, N.Y.*

Pressure blasting—Uses of wet-blasting equipment for deburring, descaling, micro-inch surfacing, and general finishing operations are described in this combination technical and promotional literature packet. The packet consists of a list of 29 actual applications, and a description of the equipment used in each. Also covered is the subject of proper compounding of pressure blast abrasives. *The Cro-Plate Co., Inc., 747 Windsor St., Hartford 5, Conn.*

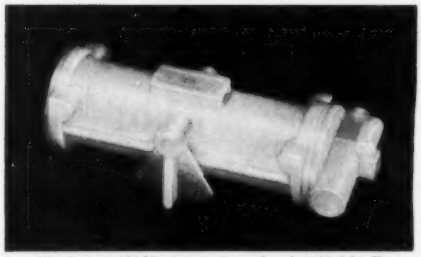
Chemical periodical—Written in non-technical language and illustrated with cartoons, a new periodical, to be published in alternate months, gives application information on chemical products and activated carbons. The first issue, for example, includes information on cost-saving uses of chemical products in such fields as dentifrices, perfumes, vitamins, decolorizing, and others. The publication is entitled "Chemmunique." *Editor, "Chemmunique," Atlas Powder Co., Wilmington 99, Del.*

Goggles—A line of safety goggles, spectacles, and face shields is described and illustrated in this catalogue. The line includes types for all eye hazards encountered in industry—hardened lenses for chipping, grinding, and impact; filter lenses for welding, burning, and cutting; and special constructions for dusts and chemicals. *Pulmosan Safety Equipment Corp., 644 Pacific St., Brooklyn 17, N.Y.*

Styrene in the home—Uses of styrene in appliances and elsewhere in the home, as well as the place of the material in the plastics family tree, are described in a 16-page booklet entitled "Plastics Today." Notes on the properties of the material, types and quality, and on the care of molded items are supplemented by a discussion of specific uses of styrene molded products. *The Dow Chemical Co., Plastics Dept., Midland, Mich.*

Tubing—Several types of corrosion-proof tubings are described in this 4-page bulletin. These include

WHEN IT COMES TO MOLDS FOR PLASTICS—



All nylon windshield wiper engineered and molded by The Danielson Manufacturing Co. for Sprague Devices of Michigan City, Indiana, represents a milestone in industrial development.

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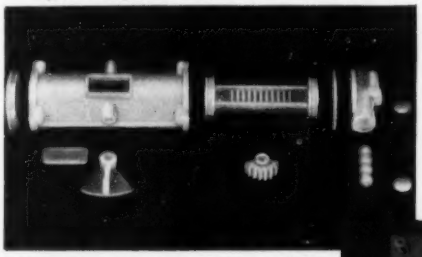

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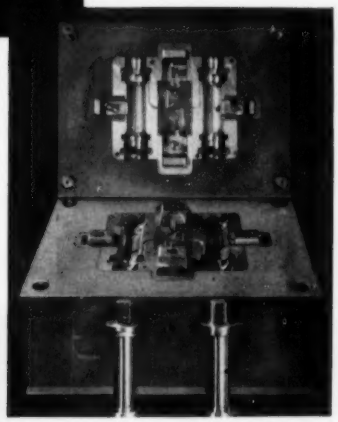
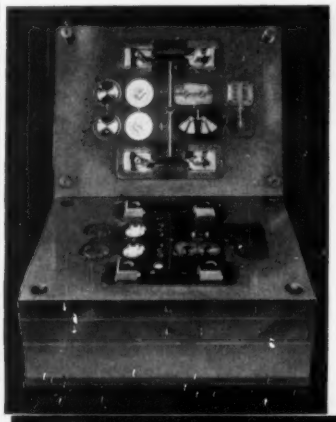
11 assembly components showing intricate design. Molded to machined tolerances—each identical, each ready to assemble into a superior functional unit.



PROBLEM: Devise a windshield wiper lighter than aluminum, more durable than steel . . . for Army vehicles and heavy trucks. Each component must be quickly, economically produced—all must fit to machined tolerances for lasting performance under exacting conditions.



SOLUTION: A 100% nylon assembly produced from an 18 and a 4 cavity mold by Parker. Components for complete assemblies are turned out in seconds with each part so clean, so free from flash that machining has been eliminated — tolerances reduced to virtually zero. Another outstanding example of the ingenuity and cooperative engineering available at Parker.

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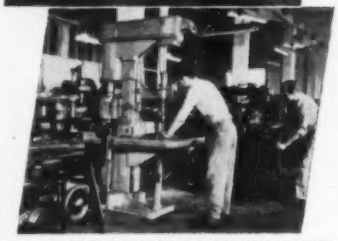

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single-line metal tubing with plastic sheath, multiple metal harness with polyethylene coating, and multiple polyethylene tube harness with vinyl sheath. *Samuel Moore & Co., Dekoron Tubing Div., Mantua, Ohio.*

Dinnerware—Describing pictorially the step-by-step process of molding dinnerware from Melmac resin, this brochure also contains an explanation of the properties and qualities of the molding compound used. *Plastics Dept., American Cyanamid Co., 30 Rockefeller Plaza, New York 20, N.Y.*

Plastic pipe—Providing specification data and application notes, two illustrated answer sheets on plastic pipes cover such subjects as effects of freezing, comparison with metallic pipes, both as to utility as well as price, and the like. Detailed instructions are presented, showing how ordinary handsaws or pipe cutters may be used to cut pipe to any desired length; how permanent, leakproof connections can be made with plastic fittings; and how plastic pipe can be connected to previously installed metal systems or threaded fixtures. Also included are descriptions of the various types of plastic fittings available. *Carlon Products Corp., 10225 Meech Ave., Cleveland 5, Ohio.*

Industrial elevators—Bulletin 5211 describes a complete line of industrial elevators and portable cranes. In its 36 pages are shown portable elevators in hand and electrically operated types, and with single, hinged, and telescopic uprights. These portables have load capacities of from 500 to 5000 pounds with lifting heights up to more than 30 feet. Also described are pallet elevators, barrel elevators—including drum dumping types—platform loading and balcony elevators, revolving base elevators, four-post elevators for heavy duty, and floor-to-floor elevators. Portable cranes and hand and electric hoists are also shown. The bulletin lists specifications, safety features, and application information. *Barrett-Cravens Co., 4609 S. Western Blvd., Chicago 9, Ill.*

Norms—An index of standards for plastics has been issued by the German Committee on Norms (DNA). Standards are covered through Oc-

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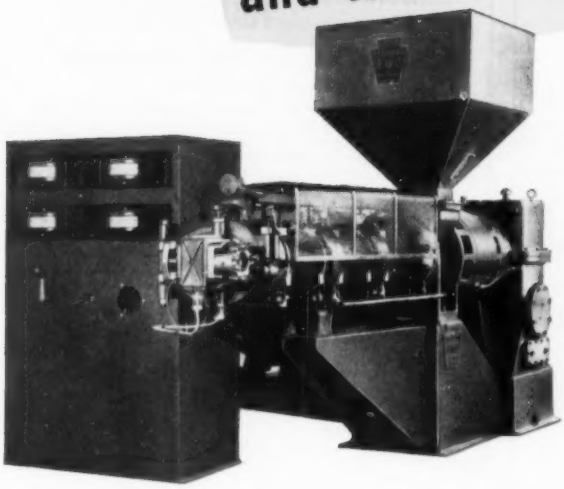

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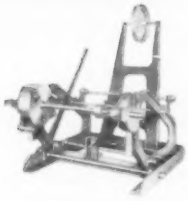
If your standards are high you'll appreciate the performance of Davis-Standards. Our engineers are ready to work with yours to solve any extrusion problem with equipment that does the job *perfectly and completely.*



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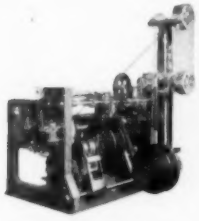
Drag and pulling type. Supplied for almost all wire plant needs. Aluminum or cast iron drums, grooved or flat, in any radius desired. Gear reducers standard, four-speed transmission optional.



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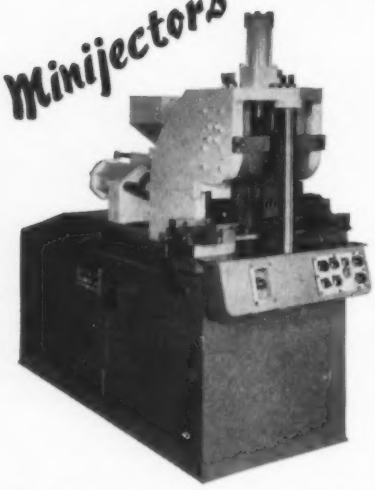

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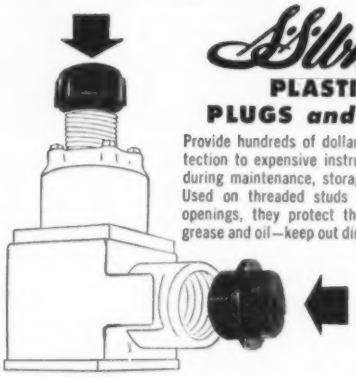

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THE *S.S.White* DENTAL MFG. CO. — PLASTICS DIVISION
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WESTERN DISTRICT OFFICE: Times Building, Long Beach, Calif.

tober 1952. *Beuth-Vertrieb, GBMH, Uhlandstr. 175, Berlin W. 15, Germany.*

Window-glazing—Covering the installation and cleaning of Plexiglas windows, Leaflet No. PL-134a explains some of the thermal expansion-contraction problems to be considered when using that material in glazing, how to handle it during installation, how to cut it, how to wash it, and how to remove spots. *Rohm & Haas Co., Plastics Dept., Washington Square, Philadelphia 5, Pa.*

Plastics industry—The sixth edition of "Plastics, The Story of an Industry" brings the development of the plastics industry up to date as of January 1953. It contains illustrations of plastic products; graphs, charts, and schematic drawings of plastics industry statistics and manufacturing processes; a list of educational institutions in 32 states offering courses in plastics; and a current bibliography. The back cover of the booklet has provisions for the imprint of a company's name, address, and telephone number. For quantity prices, address *The Society of the Plastics Industry, Inc., Public Relations Dept., 67 West 44th St., New York 36, N. Y.*

Research—Giving an outline of the work performed by the organization, this illustrated booklet, entitled "Molded Products and Coatings," describes the various research projects on which work has been done, and indicates the uses which industry can make of such research service. *The Franklin Institute, Laboratories for Research and Development, Benjamin Franklin Parkway at 20th St., Philadelphia 3, Pa.*

Vinyl stabilizers—Typical physical properties of vinyl stabilizers are presented in individual data sheets, together with check list blanks for the use of customers seeking additional information. Stabilizers listed include organic assistants—for solution applications, organosols, extension of heat stabilization, assisting copolymer stabilization in films, sheets, plastisols, and extrusions; barium—for heat stabilization and increased clarity; calcium and zinc—for cast plastisols and printable surfaces; barium-cadmium—for general

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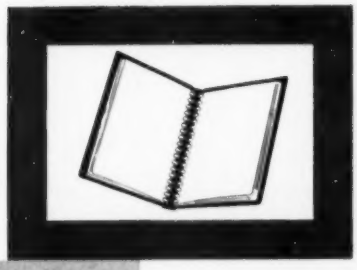

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purpose clear films and sheets and viscosity-adjusted plastisols; cadmium—for general purpose, high clarity films and sheets, for plastisols, for difficult calendering situations, for clear rigid extrusions, for improved clarity, for general translucent or pigmented films, and others. *Harshaw Chemical Co., 1945 East 97th St., Cleveland 6, Ohio.*

Chemicals—Physical and chemical properties, specifications, and suggested uses for 12-hydroxystearic acid and hydrogenated castor oil are contained in this booklet. Listed among the applications of 12-hydroxystearic acid are lubricating greases, pharmaceutical ointments, soaps, and plasticizers. Uses for hydrogenated castor oil include lubricating greases, insulating materials, plasticizers, waxes, and coatings, among others. A bibliography is also included. *Emery Industries, Inc., Carew Tower, Cincinnati 2, Ohio.*

Rubber-resin—A guide to the use of Pliolite S-6B in the manufacture of soles, heels, and related reinforced rubber products has been prepared in the form of a 28-page color illustrated manual. The text deals particularly with the effect of a high-styrene copolymer of butadiene on hot, cold, and oil-extended GR-S rubbers, and with its use in leather-like goods. Many applications are listed, including rubber-covered inflated balls, rubber flooring, extruded products such as electrical wire covering stocks, hose and gasketing, and molded items such as chemically resistant buckets and cut-resistant golf ball covers. *Chemical Div., Goodyear Tire & Rubber Co., Akron 16, Ohio.*

End grain materials—Two new 4-page illustrated folders describe end grain materials for bearing surface applications. Folder 328 illustrates applications of the material for bearings in metal planers, planer type milling machines, vertical boring mill raceways, and horizontal boring mill tables and saddles. Folder 325 provides illustrated instructions for installation. *R. T. MacAllister, Industrial Sales Manager, The Formica Co., 4600 Spring Grove Ave., Cincinnati 32, Ohio.*

Wet blasting—This illustrated 4-page booklet shows how wet blasting

is used both in the original manufacture of molds and their reconditioning maintenance to bring about important savings of time and labor and reduce manual polishing requirements. Bulletin 63 describes how wet blasting is used during manufacture to blend grinding lines, tool marks, surface imperfections, and to remove heat treat scale; and how, during reconditioning, it is employed to remove the carbonaceous deposits which form and the plastics resins which adhere to the mold surface. *American Wheelabrator & Equipment Corp., 1254 South Byrkit St., Mishawaka, Ind.*

Hydraulic pumps and controls—Catalogue. No. 5001 contains specifications, descriptions, and illustrations of oil hydraulic pumps and controls. It is fully illustrated in two colors. The following items are covered: Pumps, pressure controls, volume controls, directional controls, control assemblies, hydraulic motors, transmissions, cylinders, and hydraulic accessories. *Vickers, Inc., 1400 Oakman Blvd., Detroit 32, Mich.*

Plastics annual—The 1952-1953 edition of the "Australian Plastics Year Book" is now available for $3.85 from *Australian Trade Publications Pty. Ltd., 171 Sussex Street, Sydney, N. S. W., Australia.*

Conversion Factors—This table of hydraulic conversion factors is of interest to those who must deal with the flow of fluids in plastics and plastics lined pipes. The data are based on the following relationships: Velocity is inversely proportional to the area or pipe diameter squared; velocity head is proportional to velocity squared; and friction loss is inversely proportional to the roughness coefficient "C" to the 1.85 power and the pipe diameter to the 4.87 power. *The Permutit Co., 330 West 42nd St., New York 36, N. Y.*

Thread protection—Suggesting uses for stainless steel wire thread inserts in tapped holes, Bulletin 660 discusses design, production marketing, and maintenance applications of this method of thread protection. Some of the fields covered are internal combustion engines, industrial furnaces, and housings of impact tools. *Heli-Coil Corp., 1303 Shelter Rock Lane, Danbury, Conn.*

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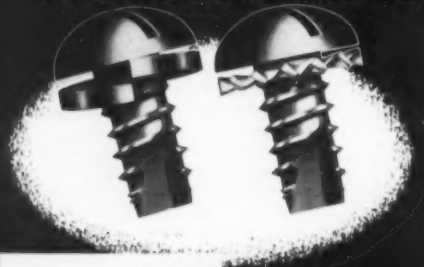

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Production of

FOR the purpose of this report, production is the sum of the quantities of materials produced for consumption in the producing plant for transfer to other plants

PLASTIC AND SYNTHETIC RESIN PRODUCTION IN 1952
From Statistics Compiled

Materials	*Total p'd'n. first 11 mos. 1952*	*Total sales first 11 mos. 1952*
CELLULOSE PLASTICS:[a]		
Cellulose acetate and mixed ester plastics:		
Sheets, under 0.003 gage	9,750,427	10,257,884
0.003 gage and over	8,940,759	8,788,267
All other sheets, rods and tubes	4,843,638	4,590,229
Molding, extrusion materials	53,499,484	53,279,499
Nitrocellulose:		
Sheets	4,679,818	4,057,140
Rods and tubes	785,710	902,739
Other cellulose plastics[b]	6,196,772	5,934,248
PHENOLIC AND OTHER TAR ACID RESINS:		
Laminating	61,356,474	40,200,601
Adhesive	34,809,242	36,413,049
Molding and casting materials[a]	155,054,599	140,721,607
Protective coatings (modified and unmodified except by rosin)	24,336,683	21,128,012
Miscellaneous uses	58,481,936	53,857,893
UREA AND MELAMINE RESINS:		
Adhesives	70,816,749	70,630,990
Textile-treating resins	27,268,740	26,209,568
Paper-treating resins	21,381,451	20,744,886
Protective coatings, modified and unmodified	21,617,861	17,274,442
Miscellaneous uses, including laminating and molding[c]	51,373,761	45,837,861
STYRENE RESINS:		
Molding materials[a]	242,907,028	221,178,819
Protective coatings, modified and unmodified	62,537,297	61,580,775
Miscellaneous uses	64,480,526	57,615,864
VINYL RESINS:[d] Total	349,567,578	331,851,645
Sheeting and film (resin content)[e]		144,027,878
Adhesives (resin content)		15,699,824
Textile and paper-treating resins (resin content)[f]		34,813,222
Molding and extrusion materials (resin content)		126,208,938
Protective coatings (resin content)		18,959,324
Miscellaneous uses (resin content)		28,426,794
COUMARONE-INDENE AND PETROLEUM POLYMER RESINS:	159,564,099	160,486,425
MISCELLANEOUS SYNTHETIC *PLASTICS AND RESIN MATERIALS:		
Molding materials[a,g]	94,244,589	89,430,629
Protective coatings[h]	39,195,768	40,212,252
All other uses[i]	96,608,508	92,827,964

* Dry basis is designated unless otherwise specified. [a] Includes fillers, plasticizers, and extenders. [b] Includes sheets, rods, and tubes, and molding and extrusion materials. [c] Data on resins for laminating and miscellaneous uses are on a dry basis; data on molding materials are on the basis of total weight. [d] Production statistics by uses are not representative, as end use may not be known at the time of manufacture. Therefore, only statistics on total produc-

Plastics Materials

of the same company, and for sale. Sales include only the quantities involved in bona fide sales in which title passes to the purchaser.

POUNDS[a] FOR OCTOBER AND NOVEMBER 1952 by U. S. Tariff Commission

October 1952		*November 1952*	
Production	*Sales*	*Production*	*Sales*
1,206,956	1,383,115	950,182	1,113,191
1,130,863	1,178,216	989,221	943,803
514,139	518,662	405,195	366,475
6,679,220	6,567,361	5,628,882	5,945,328
497,385	438,059	416,211	398,300
91,852	100,105	90,009	61,232
467,721	488,594	529,144	482,491
7,505,585	4,160,265	6,987,846	4,417,417
4,417,861	3,875,801	3,784,693	3,625,902
19,724,995	18,413,080	18,615,537	17,500,562
2,621,854	2,178,539	2,657,675	2,157,638
7,495,498	6,853,456	6,150,452	5,764,892
7,419,936	7,649,702	6,569,962	6,548,112
3,255,146	3,101,297	3,027,870	2,662,481
2,745,525	2,522,549	2,590,685	2,211,872
2,750,840	2,037,699	2,623,606	2,009,497
6,447,187	6,552,316	6,126,324	6,133,661
30,948,460	33,266,171	31,289,859	26,649,557
6,311,793	5,913,274	5,918,496	5,788,926
6,970,957	7,173,830	7,224,905	6,383,179
39,246,969	42,062,617	39,880,637	38,116,094
	16,271,100		13,666,214
	1,859,399		1,655,782
	4,310,457		3,931,758
	13,972,816		13,955,637
	2,305,864		1,787,734
	3,342,981		3,118,969
16,427,065	16,415,422	15,479,194	15,845,757
9,723,972	9,748,830	9,617,857	8,885,673
1,708,167	1,796,746	1,797,452	1,976,625
12,003,575	10,421,408	11,655,788	10,698,813

tion are given. [a] Prior to January 1951, statistics were given on the basis of total weight. [f] Includes data for spreader and calendering-type resins. [g] Includes data for acrylic, polyethylene, nylon, and others. [h] Includes data for epichlorohydrin, acrylic, polyester, silicone, and other protective coating resins. [i] Includes data for acrylic, rosin modifications, nylon, silicone, and other plastics and resins for miscellaneous uses.

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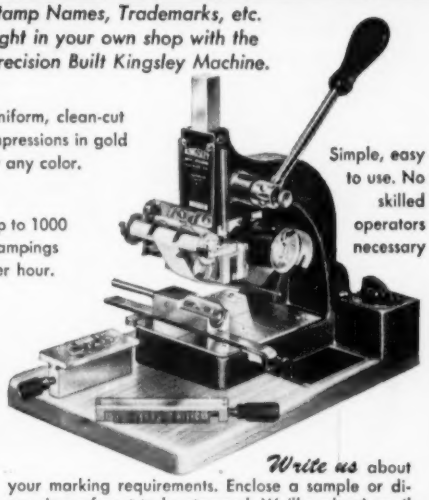

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Concrete blocks (right) which shield personnel from radiation of cosmotron are coated with polyester to prevent dusting when blocks are moved. Dust might injure mechanism

Polyester Protects Cosmotron

BY COATING concrete radiation shields with Vibrin polyester resin, a product of Naugatuck Chemical Div., U. S. Rubber Co., the danger of damage to the delicate mechanism of a giant cosmotron by abrasive particles is effectively eliminated.

Concrete blocks are sprayed with polyester, using standard spraying units

The cosmotron, located at Brookhaven National Laboratory, Upton, N.Y., is designed for use in atomic research. To safeguard personnel against any radiation emanating from the machine during operation, a series of 10-ton concrete blocks, stacked four tiers high, is positioned around the circumference of the cosmotron.

As a solution to the problem of keeping the 200-ft.-long room in which the machine is housed free of concrete dust that might rise from the blocks, which are occasionally moved, each piece is coated with Vibrin. The protective coating effectively seals the blocks with a hard, glass-like surface that will not flake off even under a weight of 40 tons.

Standard compressor equipment was used to spray the coating onto the blocks. Two coats of the quick-drying resin can be applied within a few hours and approximately 100 of the 10-ton blocks were coated in 15 working days. The Vibrin is extended with calcium carbonate and a pigment is added to give the blocks an attractive grey color. Cost-wise, the coating is competitive with paint.

From molded chairs of modern design to cast resin cable terminals . . .

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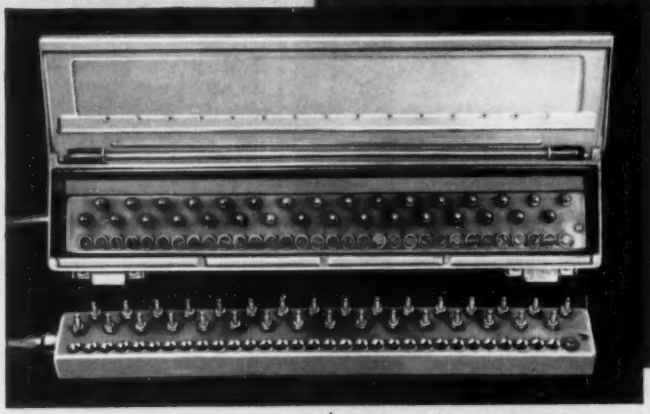
POLYESTER RESINS



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MORE AND MORE manufacturers are turning to Pittsburgh SELECTRON Polyester Resins to make their products better looking, stronger, more durable —and often at lower cost.

● **For example,** the Zenith Reinforced Plastics Company of Gardena, California, uses SELECTRON in manufacturing prize-winning Charles Eames armchairs for the Herman Miller Company of Zeeland, Michigan. No costly metal stamping tools are needed to make them. These chairs are molded with color imbedded, requiring no additional protective or decorative finishes.

● **In its Point Breeze, Maryland,** plant the Western Electric Company uses SELECTRON Resins to make telephone cable terminals of a completely new design that provides several important advantages over earlier types.

● **These resin-cast terminals** are gas-tight, prevent moisture from getting into the cables and facilitate the finding of open breaks. They have high surface resistivity and are free from cracks and pits in which dust and moisture might lodge. Protectors are integrally mounted instead of being placed alongside. Thus, substantial savings in manufacture, installation and service are effected.

● **SELECTRON,** when combined with such fillers as Fiberglas, cotton, rayon, nylon, felt, sisal, paper, etc., provides a new kind of material that is lighter than aluminum, yet—weight for weight—is stronger than steel. It has great impact resistance and withstands the deteriorating effect of weather, sunlight, heat, abrasion and many chemicals.

● **SELECTRON Resins** offer many possibilities to alert, progressive manufacturers. Why not call on us for advisory service? We'll be glad to have one of our engineers discuss your problems with you at no extra cost or obligation.

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Baskets for automatic washers
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Fishing rods
Sinks
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Nozzle Containers

PROTECTION, identification, and cost were the three factors that faced Binks Mfg. Co, Chicago, Ill., in the packaging of delicate precision spray gun nozzles. The solution was a small cylindrical container of styrene. Molding was done by Continental Plastics Corp., Chicago, Ill. on an 8-oz. machine using an eight-cavity mold.

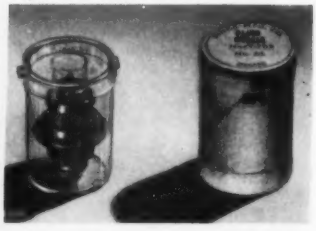
Formerly, the nozzles were placed in cylindrical cardboard boxes. The nozzle was hand wrapped in heavy paper to give it a snug fit and protection. Sealing was also a hand job consisting of the application of acetate tape printed with the Binks name. Then the nozzle number had to be stamped on the top of each box to identify the contents.

The new styrene container, made of Monsanto Lustrex, stands up to the rough treatment usually expected in handling and shipping, and also safeguards the delicate machining of the parts. The contents of each unit are easily identifiable because of the transparency of the container.

Molded into the base is a positioning pin over which the nozzle rests. The self-locking cover has a restraining collar which holds the nozzle securely and completely protects the delicate precision orifice. Where the machined surfaces of the nozzle come in contact with the plastic base, they are unharmed because the styrene is softer than the steel nozzle.

The new package makes an exceptionally attractive display and allows the contents and the identification catalog number on the nozzle to be seen from all sides of the container.

Styrene container for spray gun nozzles (left) replaces cardboard (right)



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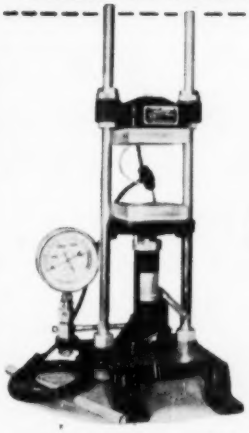

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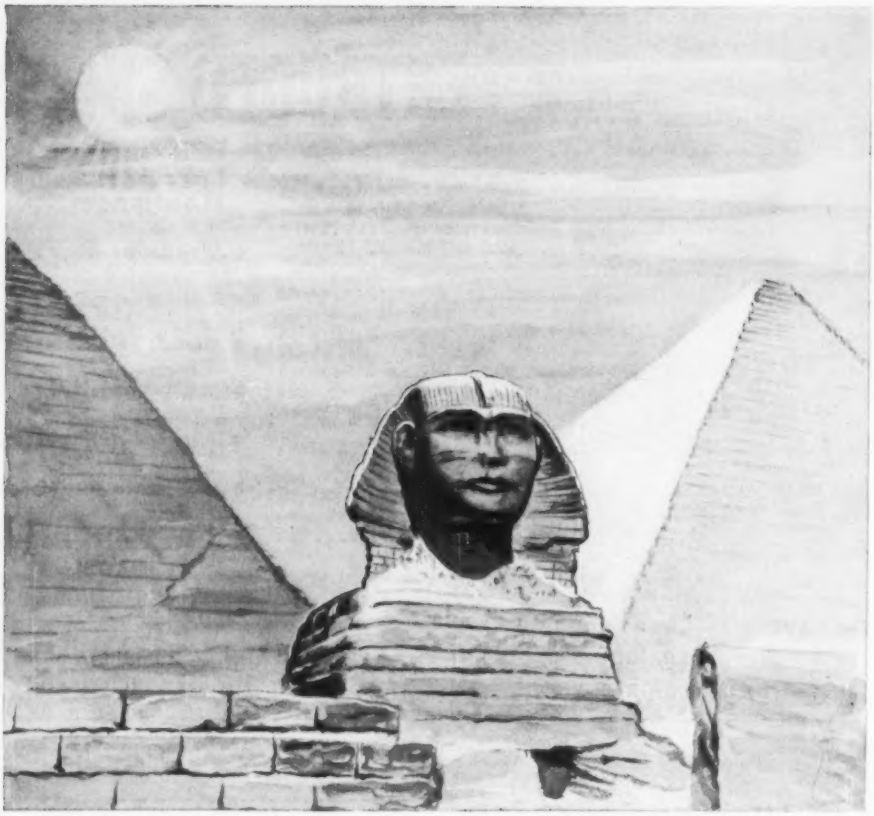

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"PLASTICS NEWSFRONT." January issue of this American Cyanamid house organ gives an interesting picture of the development, manufacture, and advantages of "Melmac" dinnerware. Illustrates styles of various manufacturers. American Cyanamid Co. **(D-305)**

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"EXON" VINYL RESINS. Data on "Exon" resins, a series of polymers and copolymers of vinyl chloride having a wide range of applications. Gives test procedure for determining characteristics. Firestone Plastics Co. **(D-316)**

RAZOR BLADE SLITTER FOR FILM. Catalog supplement covers the specifications of the "Camachine 26-R-7" for razor blade slitting and rewinding of light gage plastic film up to 62-inches wide. Cameron Machine Co. **(D-317)**

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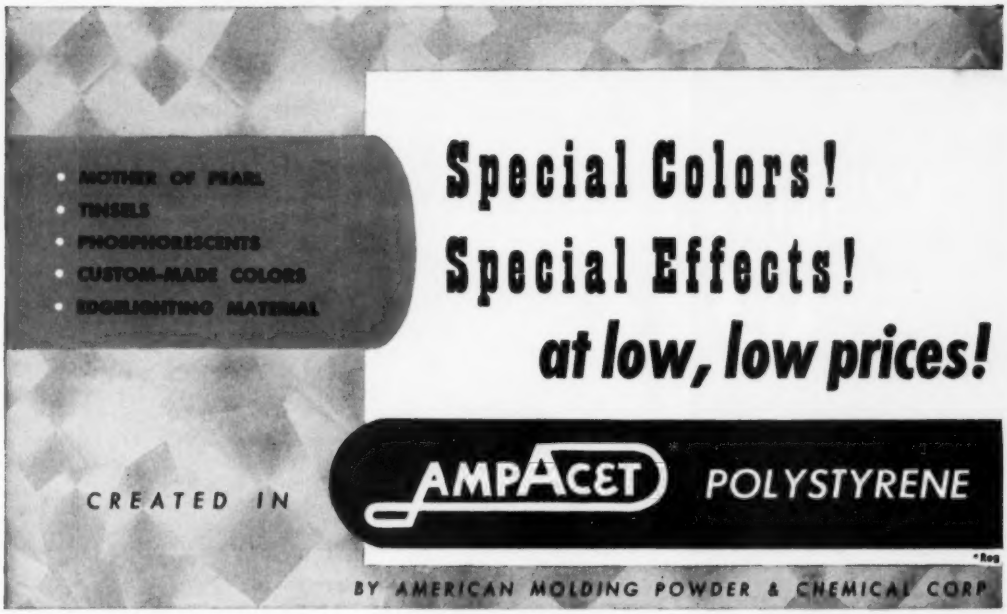

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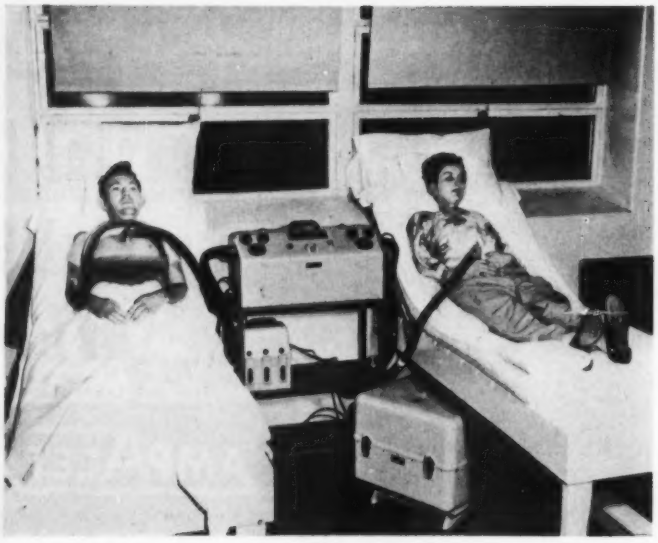

Lightweight chest shells for a portable respirator system are molded of acrylic in six graduated sizes, using the positive pressure molding method and radiant heating

Acrylic Respirator Shell

THE lightweight acrylic chest shell of a versatile portable respirator system offers comfort, convenience, and a new mobility to patients. The entire system, manufactured by J. J. Monaghan Co., Inc., Denver, Colo., consists of six of the Plexiglas shells in graduated sizes, a lightweight Royalite case finished in grey, a power unit, battery unit, and two pressure hoses. Weight of the power unit is 44 lb.; the battery unit is 37 pounds; and the shells, hose, and case, complete, weigh only 27 pounds. This lightweight compactness, coupled with the durability of the shells and other parts, enables the respirator system to provide adequate portable facilities for emergency cases and to be used during the transfer of patients by ambulance.

When the system is in use as a clinical unit, the acrylic shell adds materially to the morale of the convalescent. Covering only the body area from just below the neck down to the waist, it permits a freedom of motion and a gradual return to normal activity that is impossible with bulky iron lungs and tanks. A rubber seal around the shell, which inflates for an airtight fit to body contours, is formed so that it is a stretch fit over the edge of the acrylic; no cement is used.

While it is molded in a thin enough section for lightweight, comfortable wear, the acrylic shell still retains its relatively high modulus of elasticity and can take without buckling the air pressure loads which are continually exerted against it. At the same time, the durable shell will withstand any strain occasioned by movement on the part of the patient.

Except for the rubber sealing element and light web straps, no fittings are necessary around waist, neck, or arms. The shell can be applied to the patient and adjusted in less than 30 seconds.

The Plexiglas shells are molded in positive pressure molds using radiant heating equipment.

The shells are also used in a similar, though larger, respirator system intended primarily for hospital use. Both systems are designed for simultaneous treatment of two patients.

Slip-Proof Ladder Tread

TO OVERCOME the physical hazards of climbing a slippery metal ship's ladder that has become coated with grease, oil, or salt water, a slip-proof compound has been developed by National Engineering Products, Inc., Washington, D.C. The compound, known as Slip Proof No. II, consists of aluminous oxide abrasive grains bonded with a thermosetting plastic resin which is cured catalytically. It is furnished as a two component product—a pasty compound, complete with abrasive grain, fillers, and binders in one container, and a syrupy hardener in another. Both components are stable indefinitely until mixed. They then become completely reactive with each other to the point where a three dimensional polymer is formed.

Section of ladder tread shows how plastic-bonded abrasive is locked in

Slip Proof No. II maintains both the high friction characteristics of the abrasive particles and the water-proofness, chemical resistance, durability, and good adhesion which are qualities of the resin binder.

The compound has proved especially effective in the aluminum treads of the ship's ladders being manufactured by Great Bend Mfg. Co., New York, N.Y.

Thin, shallow grooves evenly spaced along each tread are filled with the material and subjected to a 2- to 3-hr. cure in a hot-air furnace. Adhesion of the hard, gritty inlay to the tread is excellent. Shrinkage which attends solidification is less than ½ of 1% by volume and there is little chance of seams or cracks ever opening up.

The durable compound is completely impervious to sunlight, as well as salt and fresh water, and it will resist gasoline, oil, and all common solvents.

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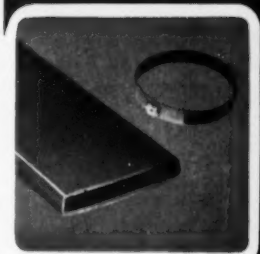
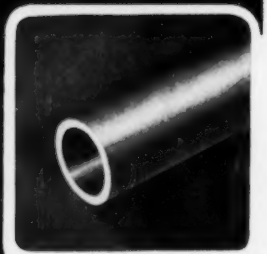


Adjustment strip for a welding helmet headband produced for Fibre Metal Products Co. of Chester, Pa.



Corrosion resistant piping made to order for the Atlas Mineral Products Company of Mertztown, Pa.

Because of the properties required in the custom extruded products shown above, H & R used Kralastic, a modified styrene-butadiene, high in corrosion resistance and impact strength.

H & R offers a complete custom extrusion service capable of turning out the right plastic material in the exact form you need, at a price you'll appreciate. We are fully equipped to make all necessary dies for sheets, strips, rods, tubes and shapes.

Send us your problem—we'll be glad to send samples, recommendations and quote prices. Absolutely no obligation on your part.

H & R INDUSTRIES Extruded Plastics

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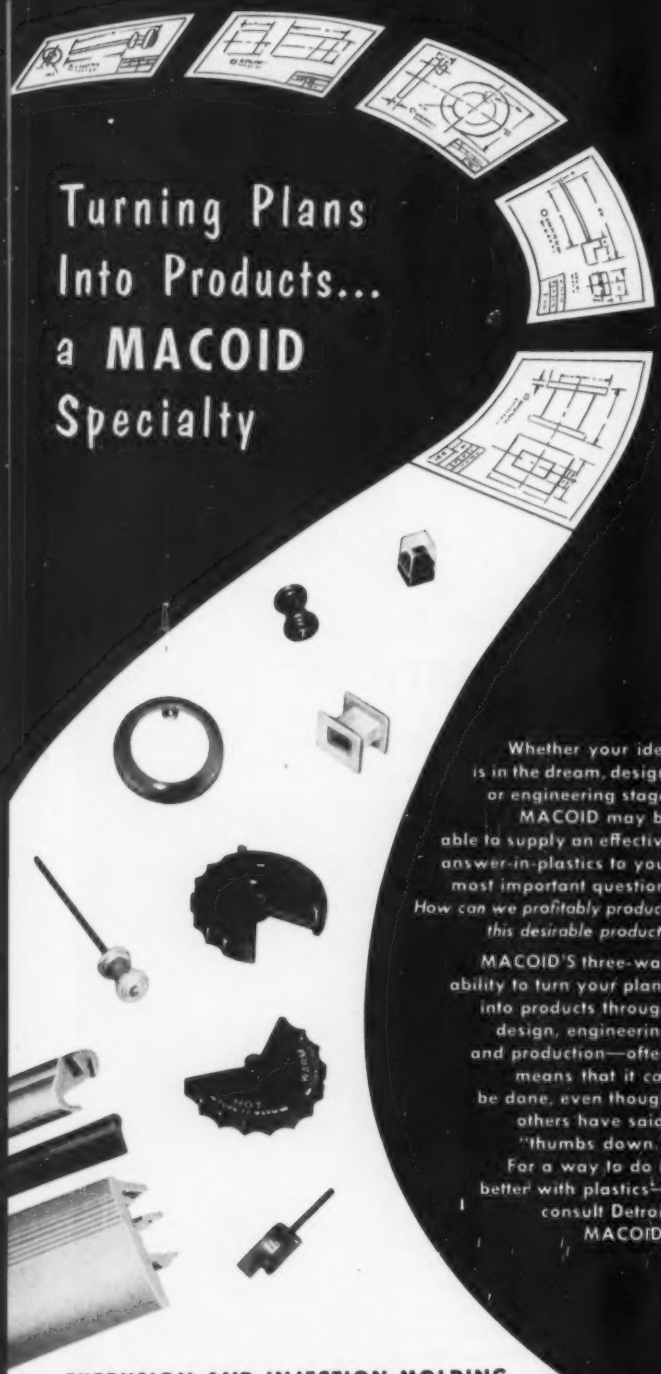
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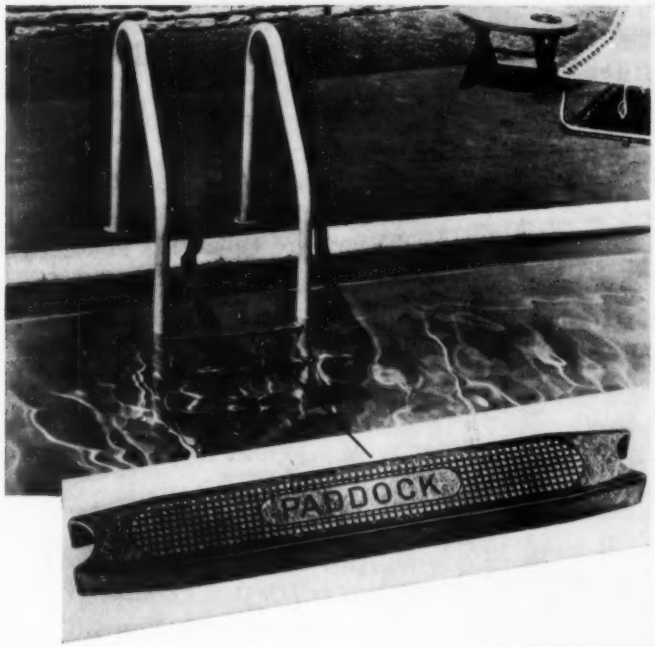
Craft Kit

CLEVER construction craft kits that use small sticks of polyethylene to form a wide assortment of shapes, satisfy both the creative and the fun-seeking instincts of children. Each Trix Stix set, manufactured by Trix Stix, Inc., New York, N.Y., has 144 sticks made of Bakelite's flexible polyethylene in four bright colors—red, blue, green, and yellow. The sticks measure 3¾ in. long by ⅜ in. wide, and are notched at each end. Adjacent to each notch is a keyhole-shaped slit into which the notched ends of other sticks are inserted and then twisted to form a locked connection. The sticks can be linked together to form figures that range from simple geometric shapes to comic animal caricatures. When a shape is completed, the Trix Stix are just as easy to pull apart as they are to connect.

The tough, durable polyethylene pieces can be used over and over again. They are simple to wash and can easily be wiped bright and clean with a damp cloth, making them well suited as playthings for children.

The sticks are held in position with the aid of polyethylene's elastic shape-memory which tends to make the sticks return to their original shape after being twisted, bent, spread, or squeezed. If a piece becomes bent after long use in a curved shape, it can be straightened by soaking for several minutes in warm water and then pressing under a heavy book.

Children can have creative fun with notched and slit polyethylene strips



Ladder steps with anti-slip treads are molded of reinforced plastics. Color and surface finish are not affected by hot sun; treads are never hot or cold to bare feet

Swimming Pool Ladder Step

ADVANTAGES over metal and wooden steps for swimming pool ladders are claimed for a newly developed reinforced plastics step. This ladder step, recently introduced by Paddock Pool Equipment Co., Los Angeles, Calif., is molded of American Cyanamid Co.'s Laminac polyester resin reinforced with fibrous glass mat produced by Owens-Corning Fiberglas Corp.

Most important talking points for the new step are a built-in anti-slip tread and a light weight of only one pound. By comparison, chromium plated brass steps weigh 7¾ lb. each and are higher in cost. In addition, the reinforced plastics step is corrosion proof, requires no maintenance, has excellent strength, and is never hot or cold to the touch of bare feet.

Color possibilities of reinforced plastics are an extra advantage. A wide color range can be obtained and, since the color is combined with the resin before molding, it will never chip, peal, crack, or blister when exposed to the hot sun. At present, the step is being offered in a choice of two colors—light gray and sea green.

The molder, Kimball Mfg. Corp., San Francisco, Calif., claims to have developed a process of special tailoring of the fibrous glass mat and impregnation of the mat with the polyester resin. Through this process, efficient production and low cost are achieved.

The name molded-into the upper surface of the step is produced by a removable plate inserted in the production mold. Thus, the Paddock company can produce and sell ladders with its own imprint, or, by changing to another mold insert, turn out steps to order for other pool contractors incorporating any desired name or design in legible, wear-proof letters or lines.

Other logical uses for the lightweight ladder steps are in aircraft and ship ladders.

REZ-N-DYE adds brilliant color to all metallized plastics

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COLOR SELLS

Manufacturers of plastic novelties all over America are discovering how much more "sellability" their products have when colored with REZ-N-DYE.

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REZ-N-DYE is the first cold dip dye on the market—applied in seconds. It's permanent, simple to handle, and economical to use. Wherever color is needed in plastics, REZ-N-DYE is the leader in its field.

REZ-N-DYE comes in 22 colors including gold, copper, antique or pastel shades—in quart, gallon, or drum sizes.

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Exceptional Service

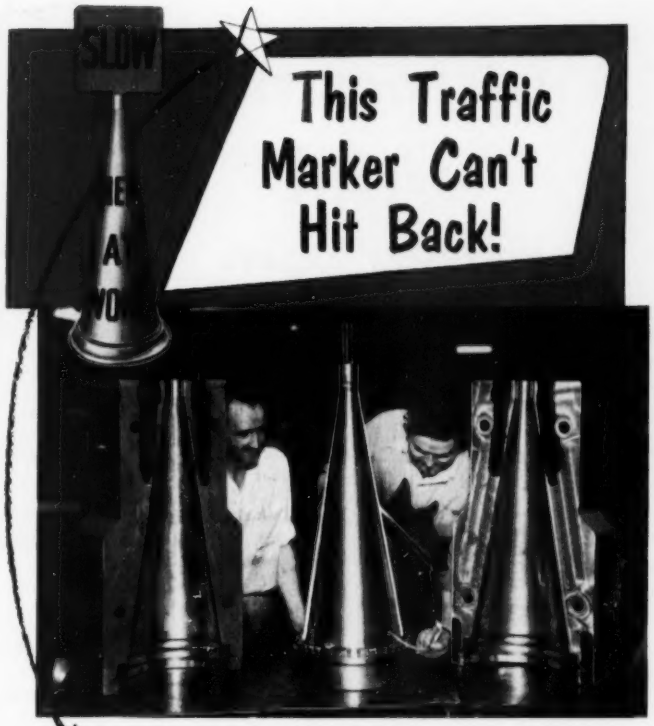
A HIGH honor has been bestowed on Dr. Gordon M. Kline, Physical Science Administrator at the National Bureau of Standards. On February 16, Dr. Kline was presented with the United States Department of Commerce gold medal for exceptional service by the Honorable Sinclair Weeks, Secretary of Commerce.

Dr. Kline, who is internationally known in the plastics field, was cited "for major contributions to science and technology through pioneering work and accomplishments in the field of organic plastics and for distinguished authorship."

Dr. Kline's work in plastics is thoroughly familiar to the readers of MODERN PLASTICS, which monthly publication he serves as technical editor, and to the readers of "Modern Plastics Encyclopedia and Engineer's Handbook," of which annual publication he is editorial director.

First Federal Government service for Dr. Kline started in 1918 as a messenger for the Honorable Herbert Hoover, Food Administrator during World War I. By a coincidence, the desk which Dr. Kline uses in his work as Chief of the Division of Organic and Fibrous Materials at the National Bureau of Standards is the same one used by Mr. Hoover when he was Secretary of Commerce in 1921-1928.

At recent presentation of medal for exceptional service. Left to right: Dr. Gordon M. Kline, recipient; Honorable Sinclair Weeks; and Dr. A. V. Astin, director, National Bureau of Standards



Molds of SPEED TREAT Plate Steel Turn Out Trafficones by the Thousand

- No doubt you have seen Trafficones along streets and highways where repairs or construction are in progress. They are molded of rubber and if struck by a passing motorist can't dent a fender, injure driver or workmen. Contractors and road builders like their low cost, their flexible resistance to breakage or distortion under constant use.
- The TRAFFICONE'S cone molds were speed-machined from Speed Treat (X1545) Plate Steel By Tri-Angle Tool & Machine Works, Los Angeles, California, for the Interstate Rubber Products Company, Los Angeles, makers of TRAFFICONES. Tri-Angle reports "wonderful success with this free machining steel over a number of years" and particularly like Speed Treat's low grinding and polishing costs and high lustre readily obtained.
- Speed Treat is widely used for rubber molds, plastic cavity retainer plates, short run trimming and blanking dies, punches and machine parts. Especially suited for flame or induction hardening as well as other treatments. Can be welded, brazed. Ask the nearest Speed Steels distributor.

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A NEW BOOKLET...

"BAKELITE Polyester Resins for Reinforced Plastics"

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Reinforced plastics made with BAKELITE Polyester Resins are introducing new concepts of structure and design to industry. They are remarkably easy to fabricate, requiring little or no pressure. They are light in weight, with a high strength-weight ratio. They can be given almost unlimited color, and have excellent light-transmission characteristics. The superior electrical properties of polyester resins are well suited to the production of electrical and electronic components where stringent dielectric specifications must be met.

This booklet, available to you without cost, describes the several BAKELITE Polyester Resins developed for reinforced plastics – gives the facts about their preparation, properties, processing, and use.

For instance, Owens-Corning "Fiberglas" cloth was laminated with one type of BAKELITE Polyester Resin—BRSQ-193 —plus 10% monomeric styrene. The resulting reinforced plastic, tested at standard conditions under USAF specification MIL-R-7575, showed these characteristics:

Ultimate Strength, Flexural, Flatwise..... 63,400 psi.
Ultimate Strength, Tensile..... 47,400 psi.
Ultimate Strength, Compressive, Edgewise.... 39,700 psi.
Impact Strength, Edgewise, (Notched Izod).....20.53 ft. lb./in. notch.

All of these values exceed the requirements of the specification. Yet, the specific gravity of this reinforced plastic, which contains about 36 to 38 per cent resin, is only 1.8.

These thermosetting materials are especially useful when strong, lightweight, large-scale moldings are called for. Boats, oil storage tanks, machine housings, furniture, radomes, plane cowlings, arctic sleds, and body armor are examples of their successful applications.

Designers and engineers will want to know more about BAKELITE Polyester Resins for reinforced plastics. Send for your copy of this booklet now!

BAKELITE COMPANY, Dept. PQ-13
A Division of Union Carbide and Carbon Corporation
30 East 42nd Street, New York 17, New York

Please send me, without cost or obligation, a copy of booklet L-10, "BAKELITE Polyester Resins for Reinforced Plastics."

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Here are some of the features covered in this booklet:

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Blends Additives Fillers
Catalysts Accelerators Colorants
Thinners and Solvents

COMPOUNDING
Resin Mixing Working Life

REINFORCING MATERIALS

PRODUCTION METHODS
Diaphragm Molding Rubber Plug Molding
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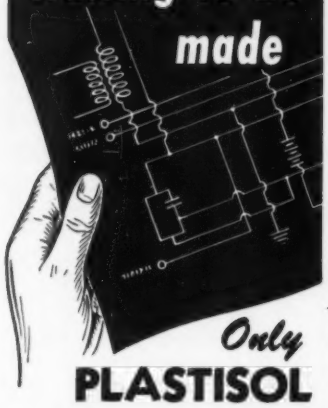

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PLASTISOL INSULATION
for Molding, Extruding or Dipping can be specifically compounded to produce these advantages:

- Ease of molding or coating—inexpensive molds or equipment required
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Whatever you manufacture, from spaghetti wiring to circuit-breaker panels, Stanley chemists can formulate a vinyl plastisol to meet your most exacting insulation requirements. For specific information write *today* to the Stanley Chemical Co., 72 Berlin St., East Berlin, Conn.

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Alkyd Plugs

HIGH temperature resistance and excellent insulating qualities of Plaskon alkyd resins, produced by Libbey-Owens-Ford Glass Co., Toledo, Ohio, are used to advantage by the Pyle-National Co., Chicago, Ill., in the manufacture of their extensive line of Triploc electrical plugs and receptacles.

These plugs and receptacles are used on all kinds of portable electrical gear, such as high-cycle tools, and on lighting and power equipment. Other applications are found in equipment employed for remote control instrumentation, communications, and sound and inter-vehicular circuits.

Alkyd was selected as the material for this application because of its superior electrical qualities such as high dielectric strength and arc resistance as well as for its dimensional stability, an essential in parts which must fit together accurately even after long service of coupling and uncoupling. Plaskon alkyd is equally resistant to heavy vibration or temperature variations and does not crack on aging.

Pyle-National also makes use of alkyd as the insulating material in their Quelarc line of circuit-breaking plugs and receptacles where unusually high electrical and physical demands are encountered under normal day-to-day operating conditions.

In addition, the Plaskon family of six different alkyd resins is being used in such other electric and electronic components as coil tops, magnetos, commutators, motor blower housings, and starter switches, as well as in television and radio parts, especially tuners, capacitors, and tube sockets.

Molded alkyd insulation is used in industrial plugs and receptacles

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WATERBURY COMPANIES, INC.
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THE PACKAGING FIELD— A BIG MARKET FOR PLASTICS

"Big market," is right! The men who select the materials used to package the output of 45 of America's biggest industries control a market that may hit the 10 billion dollar mark this year.

Typical of the 45 industries that comprise this rich market are companies which manufacture and package foods, cosmetics, chemicals, drugs, candies and tobacco products. In all these highly competitive industries frequent packaging changes are the order of the day. Factors ranging from fascinating sales appeal to plain hard costs influence the men who make the packaging decisions. Consequently, no one type of packaging material (glass, metal, paper or fabric) ever has assurance that it won't be supplanted by another.

And now plastics have entered the arena as directly competitive materials for packaging. In just the last few years they have come to play an increasingly important role —and often at the expense of older, "traditional" materials.

Especially noteworthy is the fact that plastics can be used in the manufacture of almost every basic package type: box, bag, bottle, drum, jar, vial or collapsible tube!

Right now this frontal invasion of the packaging field by alert plastics manufacturers, molders, laminators and fabricators has just begun. And their chief sales tools are the two publications which reach the men who make packaging decisions in all 45 industries—MODERN PACKAGING Magazine, issued monthly, and the annual MODERN PACKAGING ENCYCLOPEDIA.

Details about the Market

Additional data on using these media to help expand your sales to the packaging market are contained in the booklet "Facts about MODERN PACKAGING and the Packaging Market." Write for your copy.

MODERN PACKAGING

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Pneumatic Conveyor

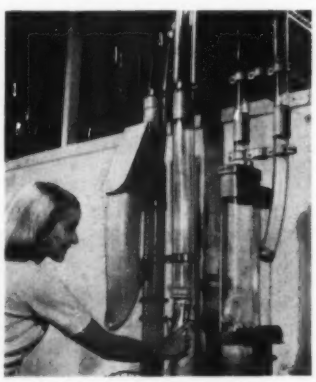
TRANSPARENT pipes extruded from clear cellulose acetate butyrate have been successfully tested in a pneumatic conveyor system under all normal service conditions. The system is manufactured by Airmatic Systems, Inc., New York, N.Y. using Tenite II, a product of Tennessee Eastman Co., Kingsport, Tenn.

In a test installation, 1½- and 3-in. lines were made up of successive lengths of pipe. The lengths were bent to run in desired planes and at required angles and were easily and quickly joined by means of a cement and thinner.

Conveyor carriers, also made of Tenite II, are propelled by compressed air and visibly shoot through the lines at a speed of 30 feet a second. In one continuing wear test conducted under normal variations of temperature and moisture conditions, a carrier made more than 200,000 trips through a 3-in. conveyor system with no apparent signs of wear on the butyrate pipe or carrier.

As a result of tests made thus far, the rugged, corrosion-resistant Tenite II is expected to replace metal in many types of pneumatic conveyor systems. Its ease of installation makes it an ideal material for this type of work. Due to its transparency, blockages of any sort can be immediately spotted and rectified without lengthy investigation.

Inserting carrier into a transparent butyrate pneumatic conveyor line



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MICCROSOL, a product of Michigan Chrome & Chemical Company, is a true vinyl plastisol which can be readily adapted, through special formulation, to meet the strictest requirements for: dipping, casting, slush molding, etc.

We will be pleased to submit a sample of one of our many proven coatings, or engineer a vinyl plastisol for your product.

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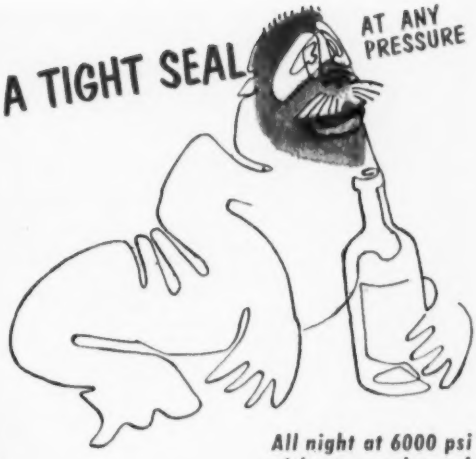

All night at 6000 psi without any loss of gage pressure.

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pipe sizes to 1 ½ inch

. . . come in the following flow patterns: Shut-off, Manipulator, Four-Way Selector, and Dual Pressure Selector.

For complete technical information see our catalog in Sweet's 1953 File for Product Designers and in the Plant Engineer's File, or write for Catalog 2B-S on Manual Valves and Catalog 1B-2 on Solenoid Valves.

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Plastics for Defense and Industry

KNOW HOW — The "know how" approach to every phase of plastics engineering and production is, and continues to be, a major factor in the over quarter-century success of the Michigan Molded organization. It is one of many reasons that Michigan Molded's recommendations and performance in doing a plastic job well — justifies the continuing interest and confidence of America's users of all types of plastics.

MICHIGAN MOLDED PLASTICS, INC. DEXTER, MICHIGAN

Offices in Principal Eastern and Midwestern Cities.

Room Coolers

(*Continued from pp. 95-99*)

problem was largely eliminated. Two other eye-appealing nameplates—one for a Carrier model and the other for a General Electric model—are molded of Plexiglas acrylic supplied by Rohm and Haas.

Housings

As injection molding of larger and larger pieces continues, the possibilities of a switch by major manufacturers to one-piece housings of plastics grow increasingly stronger and stronger.

Since plastics offer the many advantages of attractive appearance and reduced cost, the obvious step is to incorporate as much of the material in the interior cabinet as it is possible to do. Philco came out several years ago with a unit housed in a cabinet compression molded of phenolic and found widespread consumer acceptance.

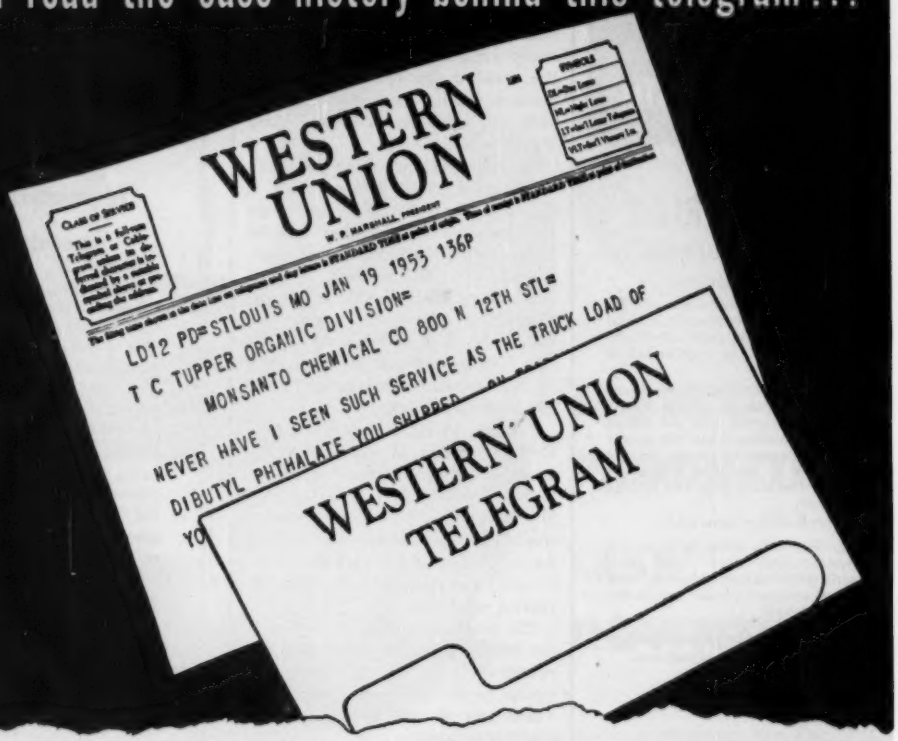
This year, Servel has introduced the first complete thermoplastic housing ever marketed. The cabinet, weighing 6.6 lb. and measuring 26⅝ in. wide by 14⅝ in. high by 15^{3}/$_{16}$ in. deep, is molded by General Electric on a 200-oz. Jackson & Church injection machine. It is molded of styrene, supplied both by Dow and Monsanto, in a single-cavity mold.

Servel, which has had such success with plastics in many of its other appliances, is enthusiastic about the all-plastic cabinet. In addition to its attractive appearance, the cabinet greatly reduces assembly costs. The 14.7-oz. overlay frame, also molded of styrene by General Electric, is fastened to the cabinet with metal clips; the four 2½-oz. styrene grilles are fitted in place with screws and springs. The chassis is then assembled in the cabinet using only five screws, three of them covered by the single control knob on top and the two visible ones topped by decorative heads.

For the all-plastic housings—as well as for the grilles, frames, dials, panels, and many other parts, this is only the beginning. With the surface barely scratched, the popularity and hence the sales of room air conditioners continues to mount . . . and plastics are growing with them—all the way to the top!—End.

Need fast service on plasticizers?

Then read the case history behind this telegram...


WESTERN UNION
LD12 PD= STLOUIS MO JAN 19 1953 136P
T C TUPPER ORGANIC DIVISION=
MONSANTO CHEMICAL CO 800 N 12TH STL=
NEVER HAVE I SEEN SUCH SERVICE AS THE TRUCK LOAD OF
DIBUTYL PHTHALATE YOU
WESTERN UNION
TELEGRAM

Time: Three o'clock on a Friday afternoon.
Place: A Monsanto sales office.

A phone rings. The purchasing agent of a large company 400 miles away is on the wire. He needs forty drums of dibutyl phthalate—*fast*. Can Monsanto help? Monsanto can and does.

Time: Later in the evening of the *same day*.
Place: The receiving department of the company needing dibutyl phthalate.

Headlights cut through the dark and a truck rolls up to the unloading platform. The needed dibutyl phthalate has arrived.

Time: Next morning.
Place: The Monsanto sales office.

A telegram arrives from the company just serviced: "NEVER HAVE I SEEN SUCH SERVICE AS THE TRUCK LOAD OF DIBUTYL PHTHALATE YOU SHIPPED ... ON FRIDAY ... WOULD YOU PLEASE SHIP ANOTHER TRUCK LOAD ... TUESDAY."*

That case history speaks for itself. While it had to do with dibutyl phthalate, it could have been any Monsanto plasticizer, in drum, tank truck or tank car. Although this was an emergency situation, it *does* typify the kind of treatment and service that is a part of every Monsanto order. For full information on how Monsanto plasticizers and resins can help you, contact the nearest sales office or MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, 800 North Twelfth Blvd., St. Louis 1, Missouri.
*P.S. With only two working days' notice Monsanto made that delivery, too.

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SERVING INDUSTRY ... WHICH SERVES MANKIND

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GLASS-BONDED MICA

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STUDY THESE FEATURES:

Withstands temperatures to 650°F., either steady or fluctuating. Can be made to any dimensional precisions of which steel or any metal is capable.

Is dimensionally stable; does not lose its precisions. Holds inserts tightly, and moves with the metals around it, because it has very nearly the same coefficient of thermal expansion as the most important metals of which inserts and casings are made.

Has no moisture absorption.

Engineers have called MYCALEX glass-bonded mica "the most nearly perfect insulator known." But it also has plenty of uses outside the electrical field.

YOU CAN WORK OUT BRAND NEW PRODUCTS with MYCALEX glass-bonded mica.

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GENERAL OFFICES AND PLANT

120 CLIFTON BOULEVARD, CLIFTON, N.J.

Fire Fighting

(*Continued from p. 115*)

terial such as a cotton, paper, or glass fabric is coated with a solvent solution of a plastic such as phenolic which is highly flammable. While every safeguard has been taken in the area of the coaters, should a static or friction spark ignite the solvent or volatiles, a severe blaze would result.

To guard against these possibilities, Taylor asked Walter Kidde & Co., Inc., Belleville, N.J., to design and install fire protection for the three coating machines. Kidde engineered two independent systems employing carbon dioxide as the extinguishing agent—one system for two of the coating machines in the Phenolic Department and the other for the experimental coater in the Research Laboratory.

The two-machine system has nine 50-lb. cylinders of carbon dioxide arranged for simultaneous discharge to both coaters. If fire occurs, the fire detectors on the machine in trouble trip the cylinders containing the fire killing liquid and also cause an electrical relay to shut down the coating machines.

The released carbon dioxide, under its own pressure, floods from the cylinders and is delivered via piping to the fire area where it is discharged as an inert gas from Multijet nozzles.

The gas reduces the amount of oxygen to a point insufficient to support combustion and the fire is smothered in seconds.

A pipe extension runs into each coater's steam-heated drying tunnel. This line has Multijet nozzles flanged into the drier's housing. When the system operates, the tunnel is also flooded with the gas.

Three 50-lb. cylinders protect the small coater, and operation parallels that of the larger system. However, this machine has a gas-heated drying tunnel. As a result, the carbon dioxide system for this machine has pressure-operated switches which, when the system operates, turn off the gas for the oven, close vents, and energize a machine restart time delay.

Besides dealing a swift death blow to coating fires, Taylor finds carbon dioxide has additional attractive features. Being an inert gas, it cannot

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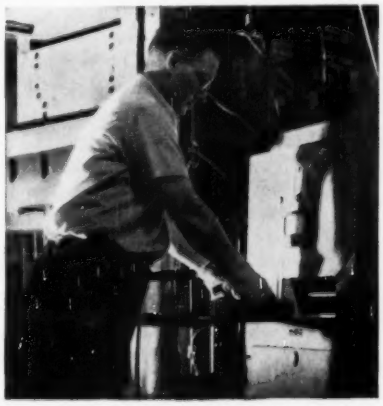

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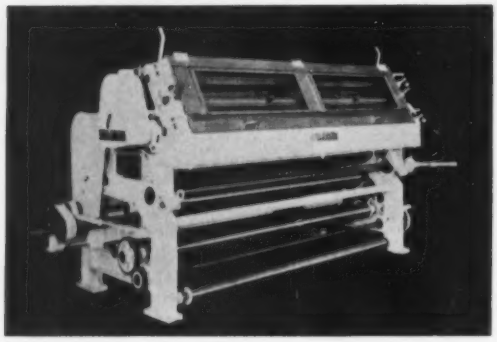

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damage machinery or work-in-process, it is a non-conductor of electricity, and, following discharge, it eventually is absorbed into the atmosphere leaving no mess to be cleaned up.

Portables

Taylor currently uses soda acid, carbon dioxide, foam, and carbon tetrachloride portable extinguishers for first aid fire fighting. A study of the entire plant determined just what kinds of fire hazards existed in each section. Extinguisher stations were then selected in central locations and equipped with the types of portables needed to fight the types of fires likely to occur in the area of each station. For example, for general combustibles (Class A), soda acid units were provided; for flammable liquid (Class B) hazards, foam portables were supplied; and for electrical (Class C) fires, carbon dioxide portables were furnished.

All portables in the plant bear "how to use" and "on what" labels, in addition to the regular inspection cards.

In connection with this program, conspicuous signs were hung from the ceiling which can be seen from nearly any area of any department. Each one has an arrow pointing to the central extinguisher station or the water hose racks and each one is prominently labeled as to its purpose.

Fire Brigades

Under company Fire Chief Henry Rhoads, three fire brigades were organized—one for each shift. Each brigade is headed by an Assistant Chief and consists of nine men. Particular care went into choosing each brigade's members from different areas of the plant. This means that a trained fire fighter will be on hand in any area of the plant in which a fire might flash. He can initiate safety procedures prior to the arrival of the full brigade.

To date, Taylor's program of fire prevention has been so successful that its plan for fire protection has never been called upon for a real test. However, Taylor executives feel that with the extinguishing equipment available in the plant, its trained brigades, working with the local volunteer department, can quell any fire problem which might arise.—END.

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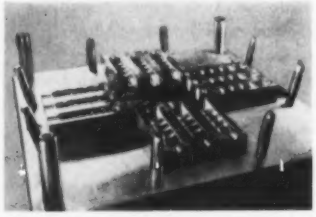

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CASE-HARDENING ALLOY MOLD STEEL FOR HOBBED & MACHINED MOLDS & FORCE PLUGS

Grading

(*Continued from pp.* 125-8)

involves the use of a small extrusion plastometer (Fig. 5), similar in construction and operation to the I.C.I. Grader (7), or melt indexer, used for polyethylene. It consists of a heated cavity held at 265° C.; the cavity is ⅜ in. in diameter, and about 5 in. long, open at the upper end and containing a die in the lower end. The die is 0.312 ± 0.001 in. long with a concentric hole 0.0825 ± 0.0005" in diameter; this is the same as the melt indexer die. A weighted plunger is used to force material out of the die. The total pressure exerted by this is 250 p.s.i., corresponding to a dead load of 27.5 lb. The plunger and a small fixed weight contribute about 5 lb. of this with the remainder in the form of a cylinder which can be set on the fixed plunger weight. The extrusion rate resulting from this system, expressed in milligrams per minute, is used as a measure of the plasticity and is called the flow index.[4]

One of the big advantages of this method is that the test sample may be in practically any form. Powder or granules may be poured in the cavity, strips can be cut from plaques and inserted, and insulation can be stripped from wire and tested directly. The time required is about 15 min. per test, depending somewhat on the plasticity, including cleaning time. Precision is somewhat better than that for the parallel plate, being $\pm$ 12% at the 2σ level for a control sample of flow index about 90 mg./min.

There is, of course, a close connection between the parallel plate melt viscosity and the flow index. A curve showing the relation between the two is given in Fig. 6. The fact that the correlation is not exactly one to one is probably a result of the different temperatures and vastly different shear stresses employed by the two tests. The shear stress effect is the most likely cause for this behavior.

Measuring Viscosity Breakdown

It is a fairly well recognized fact that the viscosity falls when fluorothene resins are exposed to elevated

[4] The details of the test method are given in a later section of the paper.

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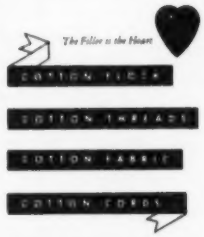

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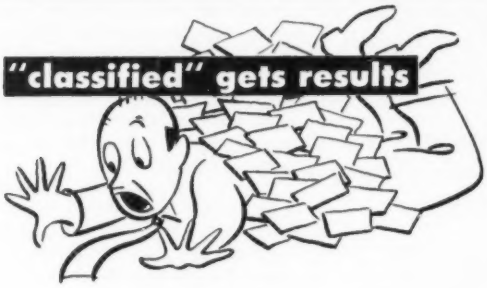

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temperatures. The molecular phenomena responsible for this also produce other mechanical changes that are undesirable. It is thus necessary to be able to detect the amount by which a resin has changed during processing. The plasticity is quite sensitive to changes of this nature and provides a good means for measuring them.

Determination of the amount by which the resin is changed by processing operations is relatively easy. Application of the parallel plate, NST, or extrusion test before and after will provide a measure of this. The final NST value may, of course, be subject to previously noted limitations. The extrusion test is usually the easiest to run on the final product inasmuch as no special sample preparation is required. As a result tests can be conducted during a processing operation and remedial action taken if excessive breakdown is observed.

Test Method

The first step in operating the flow indexer is to properly set the temperature at 265° C. Since the actual material temperature and the temperature indicated by the thermocouple (or thermometer) may be different, this setting should be done with an auxiliary thermocouple (or thermometer) inserted into molten material in the sample cavity. Once the difference between indicated and actual material temperature is determined, further such checks should be necessary only occasionally.

The die and plunger, with attached small load, should be inserted in the liner and allowed to come up to temperature. During normal usage this can be done as the instrument is warming up.

Once the temperature is stable at 265° C. the testing procedure[5] is as follows:

1. Weigh up 2 g. of the resin to be tested.
   a. If wire insulation is to be tested, strip off pieces about 2 in. long, weigh, and place in a glass tube with inside diameter slightly smaller than that of the sample cavity. This tube can then be held above the cavity and the

[5] Cleaning operations are described in steps 8 to 14. Cleaning can normally be done quickly. It is recommended that a thorough cleaning be made once every 10 to 15 tests and/or at the finish of a day's testing.

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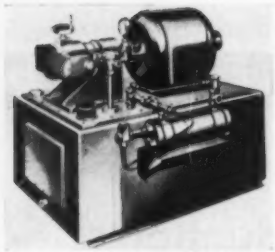

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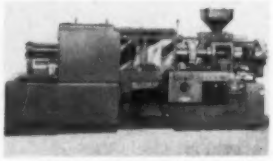
Model A-12 Hufford Stretch-Wrap Forming Machine manufactured by Hufford. Marvel Synclinal Filters are installed as standard equipment.



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sample quickly inserted by pushing with a small rod.

b. If the original sample is in plaque form, cut strips about 1/16 in. wide by 2 in. long and follow method (a) above.

c. Granules or powder can be poured into the cavity by using a glass funnel.

2. Place the weighed sample in the sample cavity of the instrument, insert plunger with attached small load, and start timer.

3. At the end of *1 minute* put the auxiliary load in place (on top of small load); stop and reset timer to zero.

4. When about ¼ in. of material has extruded, cut it flush to the die and start timer. A small spatula can be used to cut off the specimen.

5. Allow about ¾ in. of material to extrude, cut it flush to the die and note the time.

6. Weigh the sample obtained from step 5 above to the nearest milligram.

7. The flow index, which is the extrusion rate in milligrams per minute, is calculated from this weight as follows:

$$\text{Flow index} = \frac{\text{Sample weight in mg.} \times 60}{\text{Time in sec.}}$$

8. Push down on plunger and extrude the sample remaining in cavity; cut it off. This can also be accomplished by putting on an additional weight (about 20 lb.) and allowing the material to extrude while the sample is being weighed, i.e., during step 6.

9. Brush out the sample cavity with a small brass bristled brush. Standard brushes for the Bakelite

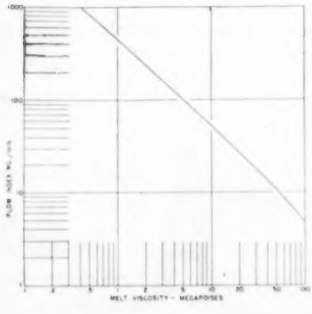

Fig. 6—Relation between parallel plate plastometer melt viscosity and extrusion plastometer flow index

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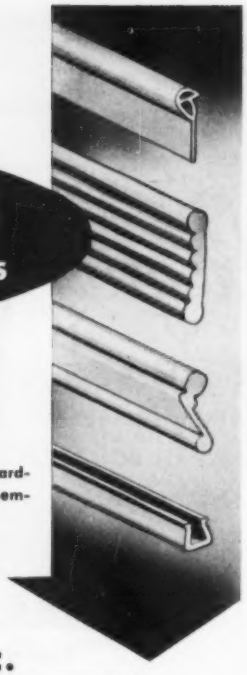

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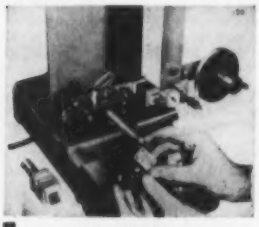

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Flow Tester are the correct size.

10. Push die out through the top of sample cavity with a brass rod.
11. Push material in die orifice out with a small brass or wooden rod.
12. Brush die off with wire cleaning brush.
13. Brush out sample cavity again; finish off with piece of cloth wrapped around brass brush.
14. Reinsert die and plunger.

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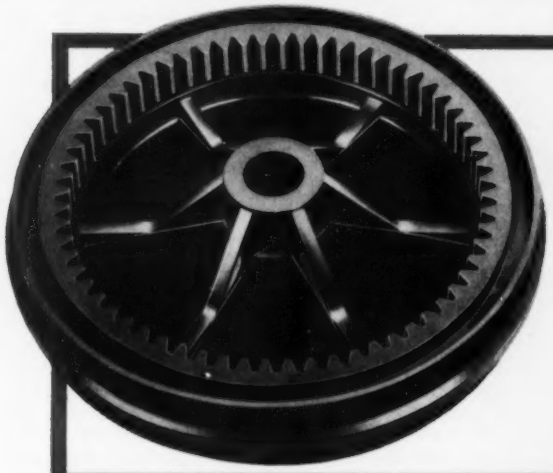
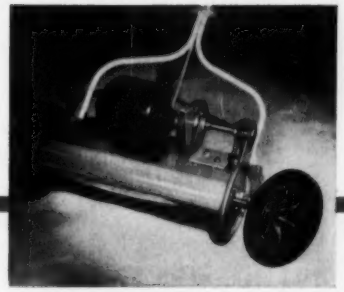


A shock-resistant G-E rubber-phenolic molding material now replaces aluminum for power-lawnmower wheels. Molded by Northwest Plastics, Inc., St. Paul, Minn., for Roberton Division, King Pneumatic Tool Company, Chicago 14, Ill., these new, lightweight wheels offer strength and quieter wheel operation.



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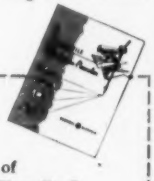

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Plastic Flow

(*Continued from pp.* 130-6)

ciency in the neighborhood of 50% under these conditions. The increased drag on the material near the back and front of the flights as well as the leakage past the worm flight will reduce the figure, while the fact that the worm flight moves faster than the surface of the stem would increase it. The back pressure will also reduce the efficiency and some pressure is necessary to keep the worm flights full and a true extrusion operation progressing. High back pressure will reduce the forward component of travel of each particle since the material can escape by pressure drop flow back through the flight space around the stem. Also, a thermoplastic material begins to get hotter from the increased work that is taking place and thus decreases the ability of the worm to generate pressure in the material and increases the temperature of the thin film of material in the worm clearance, thus promoting slip of the material on the liner and greater rotation.

It has been observed that although deep flight worms will move more material at low outlet pressure, shallow flight worms are capable of generating higher pressures, somewhat higher temperatures, and more uniform conditions by more uniform mechanical treatment of the material. Of course, the higher temperature would be expected from the higher rate of shear occurring in a shallow flight worm, but the higher pressure generated is the result of the higher rate of shear and the fact that the circulating flow cannot be so easily deflected as in the larger passage of a deep flight worm. The pressure generated by the flight face is the same in either case, but it is more easily dissipated and lost in the larger mass held in the flights of the deep flight worm. This is further clarified by picturing a pressure drop flow backward through the worm flight. Flow back would obviously be much easier in a deep flight worm. Also, cleaning out of the material in a deep flight worm is much slower, which is in accord with the observation that usually materials are better mixed on being processed through a shallow worm.

When an extruder is working against a blanked off end, there is no forwarding of the total mass of the material. In the main the action reverts to the circulating flow as illustrated in Fig. 10, and the flow lines shown in Fig. 18 are deflected to pure rotary motion. However, the

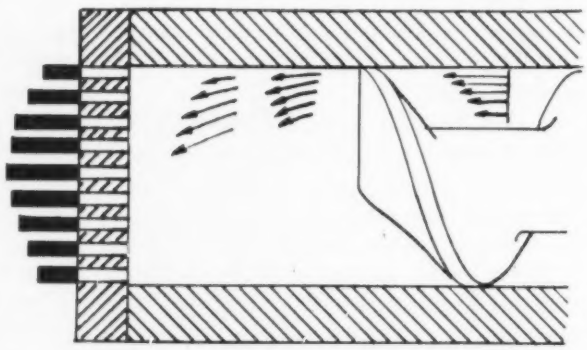

FIG. 30

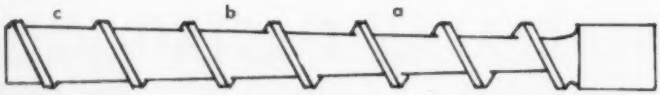

FIG. 31

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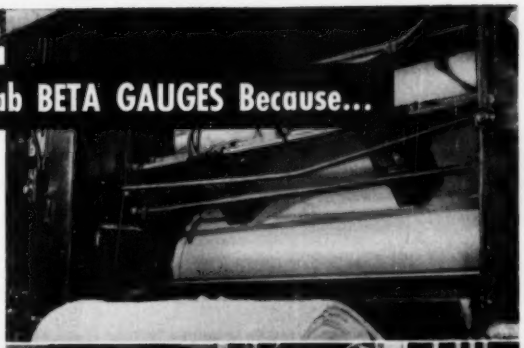

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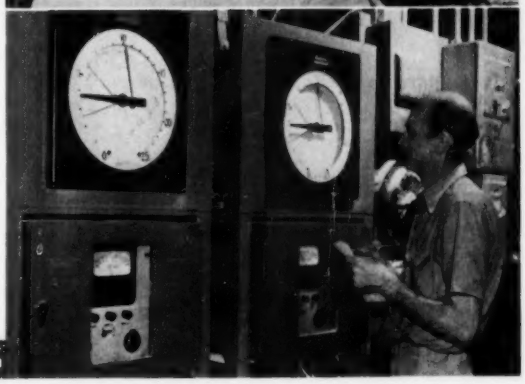

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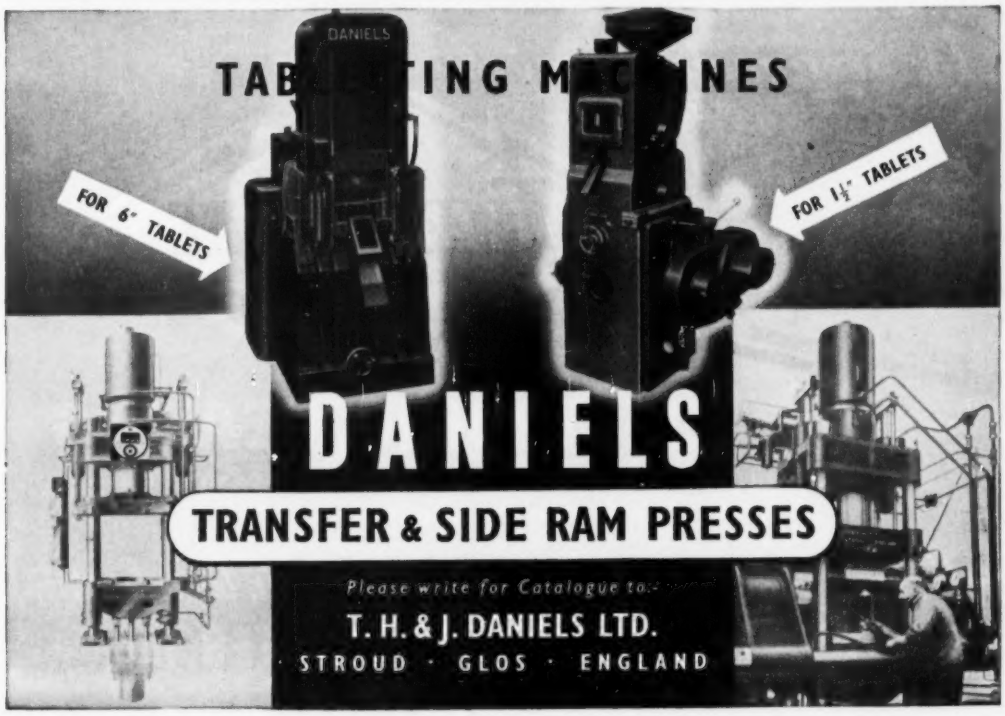

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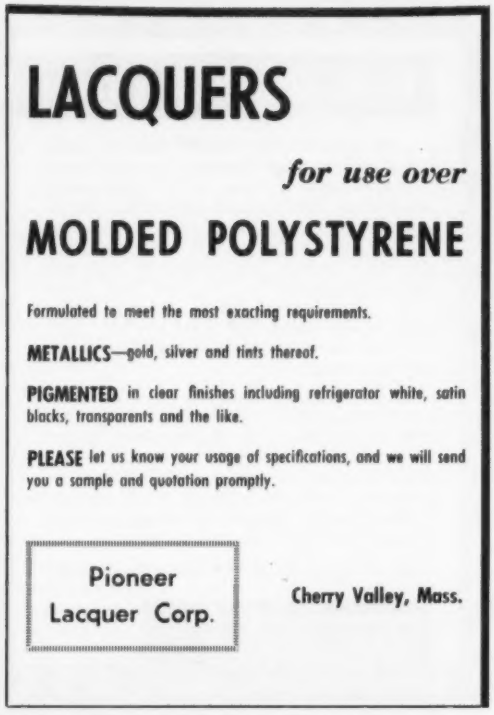
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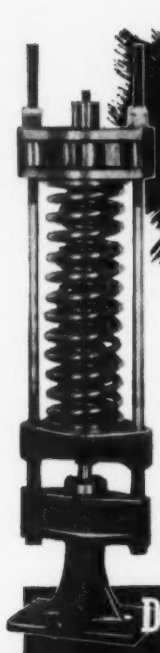

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flight is still dragging across the material as an inclined plane and generating pressure on it. Where the flight acts on the material held by the casing, as in the area of the X's in Fig. 18, it is forced forward as it moves down the flight and out into the flight space. Some of it reaches the lower pressure area in the center of the flight space and beyond, and is deflected to a backward flow which must compensate for any forward flow and average out to zero axial flow. However, some of the material continues to move forward close to the pushing face of the flight and advances to the front of the worm and forces a like amount to flow out of the reservoir between the end of the worm and the blank die and back into the low pressure area at the rear face of the flight, which material becomes part of the reverse flow. In Fig. 24 the line F represents the material close to the flight that is moving forward while line R represents the flow of the material that rotates with the worm in circulating flow and flows backward as it moves away from the pushing face of the flight. Of course, the material flowing backward at R also includes the material that is returning after flowing forward at F. In an effort to clarify the illustration the flow of F has been shown in relation to the worm as in Fig. 22, while the flow of R has been shown in relation to the casing as the dotted line in Fig. 21. In Fig. 25 if we consider the line L-L' as being on the worm and rotating with it, then the curved line shows an average flow that will occur over and above the circulating flow, as illustrated in Fig. 10. Forward flow will occur at F and reverse flow at R. These are also shown at F and R in Fig. 10.

It is clear that this introduces high shear in the material at high pressures. This is exaggerated in shallow flight worms because the reverse flowing material has difficulty finding a channel through which it can flow backward. In the deep flight worm the area close to the worm stem and close to the back face of the flight, being farther from the pressure generating area, more readily offers a channel for reverse flow. If such an operation is continued, the material rapidly rises in temperature due to the severe working. This brings about a softening of the material with a consequent pressure drop all along the line and then decomposition.

Cooling a worm through use of a cored hole results in the worm working like a shallower worm. The most rapid rate of forward flow is moved closer to the casing with consequent increase in rate of shear, as shown in Fig. 26. It has the advantage over using a shallower worm in that heat is continually removed from the material, reducing the danger of overheating that might otherwise result from such severe work. Less material is participating in the circulating flow.

Leakage of material past the worm flight has the disadvantage of decreasing the output through the loss of material. In addition, the material gets heated up from the severe shear in this narrow clearance. As the worm flight passes by, this hot soft material exerts less than usual drag on the material at the rear of the flight. This permits the material to rotate more freely with the worm than happens further along after the heat has become dissipated by conduction and the material is sheared off by the stiffer plastic held in the

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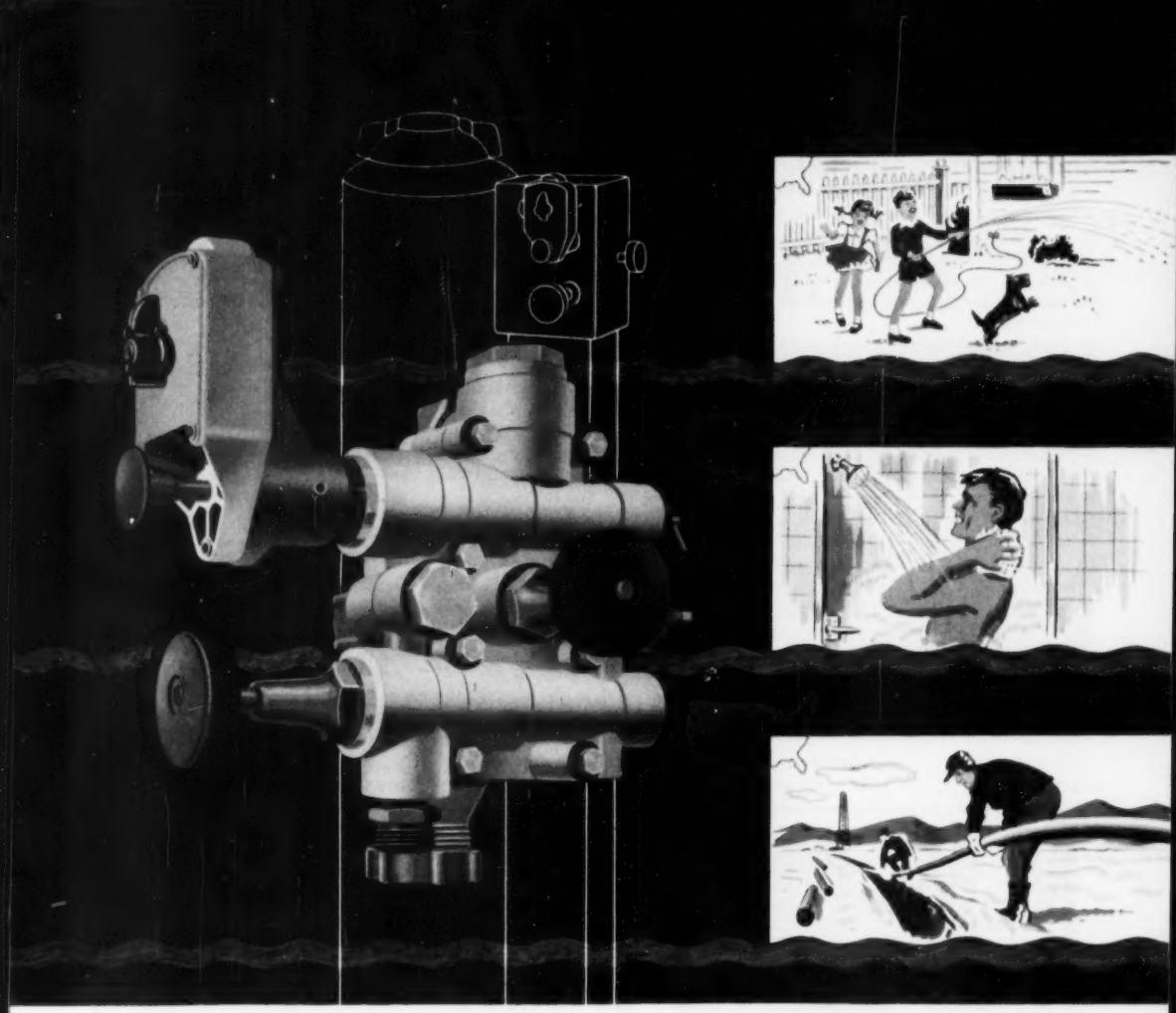
flight. Thus, the drag flow existing in the material at the back of the flight might appear as shown in Fig. 27. Permitting the barrel to get too hot prevents the cooling of this film of material and results in the churning and overheating of the material.

If the material being treated has the same adhesive as cohesive strength, maintains a uniform viscosity at varying rates of shear, and does not change viscosity too rapidly with change in temperature, a rather accurate determination of the actual flow of each material would be possible. Since few materials fulfill even one of these requirements, variables are introduced from these basic lines of flow for which allowance must be made.

Forward Flow By Planar Shear

In the general category of extrusion of clays and claylike materials, the influence of circulating flow is probably much lower than in thermoplastics. One observation which seems to confirm this is the fact that rather high pressure, several thousand pounds per square inch, can be built up in three or four turns of a deep flight screw. It would be expected that the material would flow backward around the worm if its flow properties were good enough to permit much circulating flow. Thus, we have drag flow in the direction of worm rotation and a type of solid flow moving forward. The material in the middle of the worm flight advances by the thrust of the flight more or less as a moving plane; the material closer to the liner moves forward more rapidly and with less rotation. The rapid forward flow near the outside diameter is confirmed by the fact that in extruding a clay through a multiple orifice die having an all-over pattern of holes, the output rate of the holes around the edge of the die is considerably greater than those in the center. In a machine with a 2-in. diameter screw having a die spaced about ½ in. from the tip of the worm, the rate of extrusion across any diametral line will appear as in Fig. 28 (varying according to material). In some cases, the difference in rate will be four or more to one. If the die is spaced out, the drag of the casing between the worm and die exerts itself and the flow of the outer holes slows up, as shown in Fig. 29. A further spacing will result in



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streamline flow as shown in Fig. 30.

The plasticity of these materials varies widely. Some materials develop planes of slip which impair the extrusion process such as near the surface of the casing. Probably a thorough study of a material's plastic properties would explain its action. So far, the simplest way to analyze its properties is to try it in an extruder.

Most extruder screws are built with a positive compression ratio, that is, the free volume of the flight decreases in going from the hopper to the die. There does not seem to be any direct relationship between the bulk factor of the material processed and the compression ratio of the screw. For instance, if a granulated material having a bulk twice what it will be in solid form is processed through a screw having a compression ratio of 2 to 1, the material will be fused and densified when a short distance up the extruder barrel where the effective compression ratio from the front of the hopper to the point of densification will perhaps be 1¼ to 1. Thereafter, material requiring no further densification will be processed by a screw having a compression ratio of 1½ to 1 or better.

The fact that the compression ratio is needed has been demonstrated many times in practice. It appears that its benefits are in the way the densified material is extruded and in the way it melts down the feed rather than in any direct relation to the bulk factor of the material.

As we visualize the molten material moving along the reducing volume of the screw, the shrinking in of the walls of the chamber holding the plastic (casing on one side, worm stem and flights on the others) subjects it to hydraulic pressure, tending to force the material forward and backward along the flight. One of the primary purposes in creating this condition is to press the material against the surface of the casing under high pressure. This pressure makes the material resist rotation with the worm. To the extent that average rotation of the material is reduced (less the decrease in volume of material in the flight), the output is improved.

It is probable that in most extrusion operations where a cold feed is being plasticized a very small percentage of the total heat put into the material comes from the jacket, the major portion of the heat being supplied by the mechanical action of the worm. The jacket heat serves to start the plasticizing of the feed and influences the action of the worm throughout by influencing the temperature of the material next to the casing and thus affecting its adherence and viscosity. Very little heat is actually conducted into the mass of the material.

Melting Down

In melting down from a granular or powder feed, the initial plasticizing of the material probably comes from two sources: the softening of the material from contact with the hot surface of the casing and admixture with plasticized material present in the worm into which the granules are pressed. It should be borne in mind that a worm with a 3 to 1 compression ratio that operates with 20% efficiency is working at only about 7% efficiency on the densified material in the melting zone. Thus, there is considerable slip and mixing of material in this zone. As the material churns through cir-

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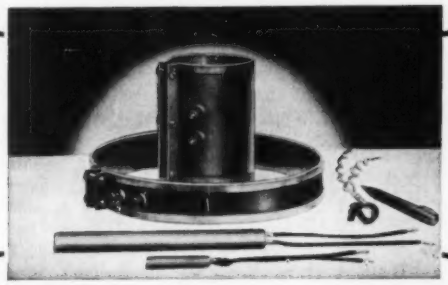

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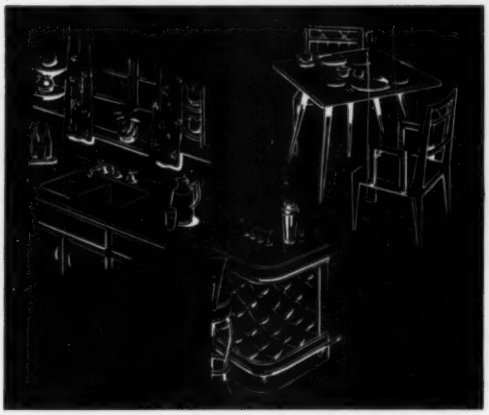

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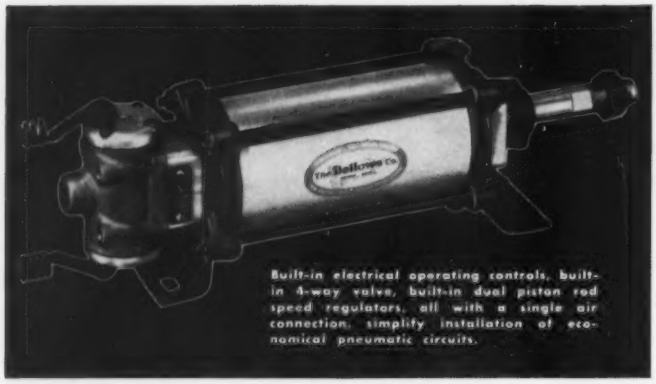

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culating flow, it constantly picks up granules that are being conveyed forward from the hopper and on which a certain amount of pressure can be generated due to their adherence to the hot casing. The continuous supply of cold granules keeps the temperature of the material in this section low and thus stiff enough to permit the development of an appreciable pressure. The front end of the worm must also be able to develop the pressure required to advance the material so that this portion of the worm will not act as a drag but will remove the material and permit the flow of granules and newly plasticized material along the worm.

In addition to keeping the material cold in the melting section, the presence of a large percentage of granules has a keying effect. This tends to promote solid flow and creates a high pressure grinding action on the material as it moves into the more restricted flights, thus doing a large amount of melting down through mechanical action.

The shape and size of the granules influence the ability of the worms to melt the material down at a high rate and affects the design of worm to be used. Diced polystyrene melts down at a high rate whereas small spherical beads are more difficult to process, probably because they have a poor keying effect. It has also been observed that a small amount of feed material showing on the worms in the hopper as opposed to using a full hopper sometimes produces a change in the operation. This is probably due to the grinding and preheating that takes place while the cold material is churned at the hopper, thus creating a different character in the feed. In one case, plasticized material backed up into the hopper and the rate fell off, while in another case a considerable increase in rate resulted from a full hopper. It is probable that in most operations a relatively cold worm and casing are required in the melting zone. Too hot a casing permits the stiff newly melted material to turn with the worm.

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In determining the proper design worm for a certain job, it is usual to try a deep flight reducing pitch worm and then a constant pitch reducing depth worm, and based on

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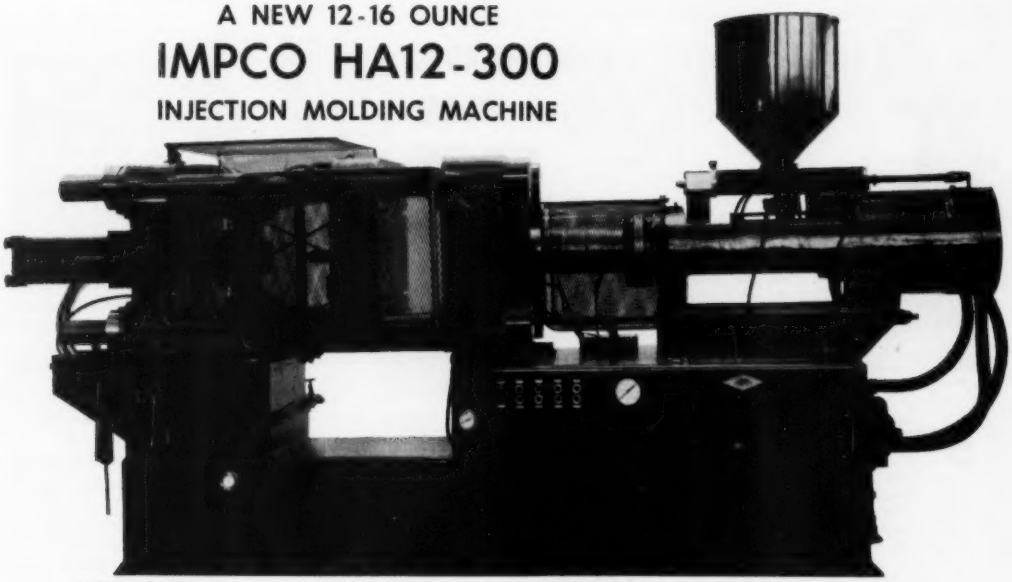

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Clamping Pressure—300 Tons Stroke—12½"
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Machine to Cycle (Dry Run)—6/minute
Dimensions—173" long—50" wide—86" high

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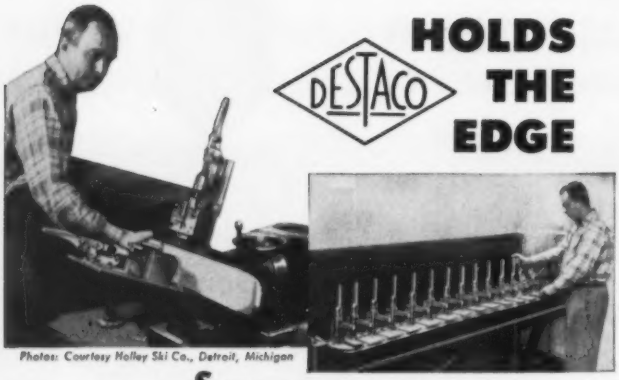

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Photos: Courtesy Holley Ski Co., Detroit, Michigan

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these results try some other variation if the engineer's past extrusion experience leads him to be dissatisfied with the results. Of course, any other series of tests might be tried but it is cut and try, modified by experience. The actual worm determined upon is one which gives a good condition at the key point for the particular operation being conducted, but may be otherwise weak.

For instance, in Fig. 31 the worm may do a good job of melting down the material at position "a" and, although it does a poor extrusion job throughout the rest of its length, the overall result is considered satisfactory. With another material, the construction in position "b" may advance the material well although the melting down is poor and the end "c" is a drag on the operation.

If the portion "c" is retarding production instead of increasing it, then the extrusion pressure is being generated farther back such as at "b" or "a". In such a situation, using the volume of the flight "c" to measure efficiency is incorrect, since its action begins to approach that of a torpedo and the flight starts to lose its significance. It would be more correct to base efficiency on the flight volume where the material is first fully densified. Consideration should also be given to using the average flight volume from the front of the hopper forward in determining efficiency, or an average taken from the melting zone forward would probably be better where the melting zone can be determined.

We are starting to see worms developed that are specifically adapted to the material being processed, such as the nylon worm that has a slow reduction in pitch for most of its length and then a rapid reduction in depth followed by uniform flight for the last few turns. Other worms include specially designed features.

We will all look forward to the development of worms that are of the optimum design for melting down the feed, conditioning it as it advances under pressure and generating the necessary pressure at the front end to carry away all the material melted while also giving the mixing and compounding desired. Although the design would vary for different materials and feed forms, worms with as wide capabilities as practical will be required—END.

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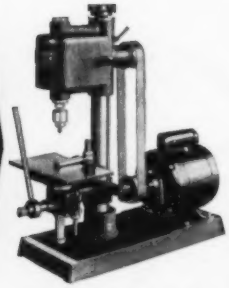

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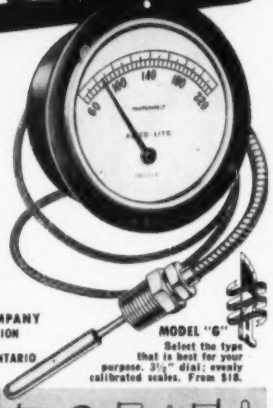

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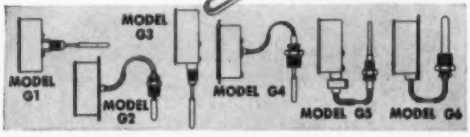

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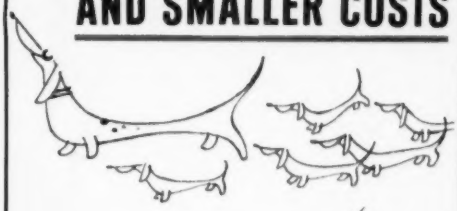

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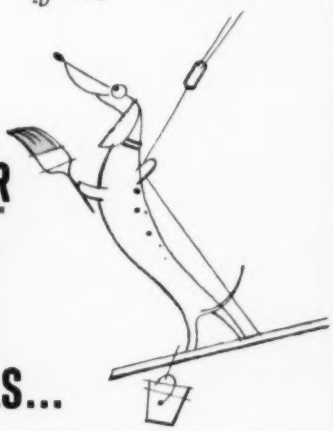

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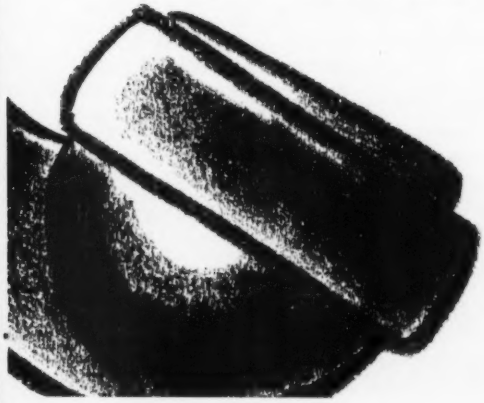

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THE PLASTISCOPE*

NEWS AND INTERPRETATIONS OF THE NEWS

By R. L. Van Boskirk

Polyethylene Problems Grow More Serious as Demand Increases

THERE is as yet no let-up in the excess demand for polyethylene. In fact, February demand was greater than January. It continues across the board in every part of the plastics industry where polyethylene is wanted. Government or D.O. orders are still requiring from 3 to 4 million lb. of a 10 or 11 million lb. monthly production, with one supplier reputedly hit a bit harder in the percentage he is required to channel into D.O. orders.

However, it seems likely that the amount of polyethylene used for the Armed Services' wire coating program should decline by at least a few hundred thousand lb. a month very soon.

Clothing Bags for Air Force—Whether or not the Armed Services' packaging program will continue to increase is impossible to even guess, but there were certainly some indignant snorts from polyethylene users when it was reported that large quantities of 3 and 5 mil polyethylene film was being used to package all Air Force clothing before shipment. Since such material would supposedly carry a D.O. order, polyethylene processors want to know why the Air Force should have preferred treatment for this particular application, when most any other plastic film could do the job.

A look through retail stores gives a good idea of why polyethylene is in such great demand. There must be literally thousands of vinyl tablecloths and similar materials, baby mattresses, and other housewares now packaged in neat, giant sized polyethylene bags. And the kitchen departments of stores are well stocked with yards and yards of polyethylene film for refrigeration or deep freeze wrapping, to say nothing of the thousands of containers now on the shelves.

Supply Problems—The relief that might be provided by one of the suppliers coming in with another one or two million pounds of additional supply in the first quarter also seems to have vanished and may not materialize until the second quarter. There is a limited amount of British polyethylene on the market, but processors report that it costs around 73¢ in comparison to the domestic material at 47 cents. They also state that minor adjustments are necessary in processing methods when this material is used. Processors have reported purchases of spot lots of polyethylene from fly-by-night dealers in small quantities at a price as high as $1 a pound—and some of it is reworked material at that.

Still another facet of the price structure is in polyethylene coated paper where several producers report a hectic situation caused by companies who have just recently started operation. These newcomers are seeking customers by offering low prices despite the scarcity of material and the cost of new coating equipment. The purpose is supposed to be that of obtaining customers for some future time when material will be plentiful. Yet in the polyethylene coated paper branch of the industry, where there are assumed to be 15 or 20 processors, production is estimated to be only 10 or 15% of capacity with three or four companies doing 70 or 80% of the business. If they all operated at capacity, they would require a tremendous quantity of polyethylene and the scramble for markets would really be wild.

Big Demand Won't Assure Big Profits—Regardless of the ever-increasing demand for polyethylene, there are many omens to indicate that a happy ending will by no means be the lot of every one of the flock of producers and processors who are now living with or contemplating wedlock with this marvelous material.

This ominous warning comes from men who have been wedded to polyethylene ever since it became available in commercial quantity in the United States. They assert that the honeymoon days for polyethylene, when its magic name produced a quiver of excitement in the pulse of the prospective user, will soon end. Now that the material has assumed big volume use, the users are beginning to demand more perfection in performance. They won't take "any old thing" just because it is made of polyethylene. Sacks that may split open down the seam, seals that may not seal, and other problems that always seem to plague any given plastic when it attains big volume use have upended the plans of many new entrants into the field who expected to suddenly become millionaires in this lush field. They haven't yet learned that technique of operation can be mastered only after long experience.

Complaints Increase as Volume Goes Up—Of course, most of these problems will eventually be overcome. The veterans in the field have already mastered many "tricks of the trade," but some persons who think that polyethylene is going to be their "high line" to fame and fortune are going to be shocked; some may get enough current to kill.

The above prediction by a veteran polyethylene processor applies to prospective producers as well as producers' customers. It is well known in the industry that despite years of experience, present producers have by no means whipped all their production problems. Their customers frequently complain that they are unable to obtain uniform deliveries, especially of the highest grade flake needed for highest grade film.

Other complaints revolve around the difficulty of heat sealing polyethylene properly because of its sharp melting point; the problem of finding adhesives that will cling tenaciously to it adds to the prob-

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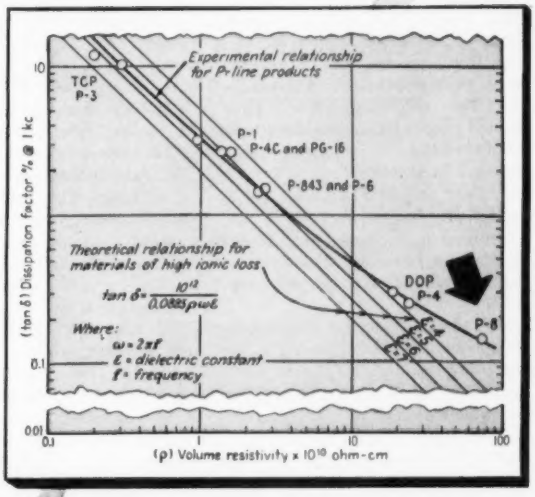

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lems. One polyethylene paradox is its grease-proof properties: sometimes it works perfectly, but certain greases and oils just seem to walk right through it.

Applications Must Be Selected—Vapor impermeability of polyethylene is very good for water and some kinds of gases, but must be carefully tested before used for many things where impermeability is important. This factor affects its use not only for film, but for bottles where all kinds of tests for impermeability and aging must be tried before the polyethylene bottle can be used.

Strength in comparison to other films is not too great. Printing on polyethylene is still a more complicated process than on most other film.

In thick sections of 10 mils or more, it may develop stress cracking. The older processors have learned how to overcome these problems but it requires expert technical knowledge.

A clear polyethylene film is also needed. Producers can make it but, when they do, the pesky stuff blocks or sticks to itself and thus destroys one of polyethylene's inherent properties.

Polyethylene has not cut into the cellophane market too deeply as yet and probably never will affect many cellophane markets, but it will impinge on the fields of soft goods and certain food products, especially frozen foods and large-size produce bags for such things as apples and potatoes. Polyethylene film 1.5 mils thick now sells at about 3.6¢ for 1000 sq. in. in comparison to various competitive grades of cellophane that sell for 2.8¢ to 4.5¢ for 1000 sq. inches.

Competition Will Get Tough—The above is by no means intended to deprecate the wonderful prospective future for polyethylene. This writer still stands by his forecast of last January that polyethylene may be the largest volume plastic in existence by 1960. Nevertheless, there are certain warning signs along the road that need to be heeded lest polyethylene gets a black eye with the consumer because of lack of technical and market knowledge on the part of processors.

The development of many plastics has been retarded by get-rich-quick ambitions of enthusiastic entrants into the field who all too often have no conception of the technical melee into which they have jumped. The polyethylene industry is no easier and no more difficult to master than other branches of plastics. But it is not going to crowd all other plastics off the map, nor is anyone going to make a success of it until they have acquired know-how and are in a position to withstand the intense price and quality competition that is certain to follow just as soon as all the extruders and molders now in the business begin to get enough material to operate at anywhere near capacity.

Road Show

LARGE hotels throughout the country are being used as exhibit halls to show a Rohm & Haas Co. exhibit that requires 1500 ft. of floor space. The exhibit consists of acrylic plastics used in the fields of aircraft, automobiles, signs, glazing, and miscellaneous applications.

The purpose of the showing is to demonstrate the design techniques and uses developed for Plexiglas. Three-day exhibits are given in each city. The initial showing was at Los Angeles in March and the exhibit is scheduled to reach East Coast states in September and October.

Laminate for Insulation

SUPERIOR insulation resistance under humid conditions is claimed for a new high-pressure phenolic paper base laminate produced by General Electric Co.'s Chemical Div. The new laminate, called G-E 11541 Textolite, enables greater tuning stability in television and radio circuits.

Styrene From New Plant

SHIPMENTS of styrene molding compound are now being made from Monsanto Chemical Co.'s new Plastics Div. plant at Port Plastics (near Cincinnati), Ohio. David Guarnaccia, manager of thermoplastic sales, said that one of the biggest volume products of the new plant will be styrene crystal for housewares manufacturers who use the dry coloring process. The new plant will be helpful in improving service to midwestern molders.

This is the third plant to produce Monsanto styrene. The other plants are located in Long Beach, Calif., and Springfield, Mass.

Production of phenolic foundry resins and laminating varnishes was started in the Port Plastics plant last fall.

Large Moldings

LEADING industrial designers and representatives of the plastics industry will meet in New York soon to discuss new and dramatic uses of large plastics moldings in furniture, radios, television sets, air conditioners, appliances, and office machines.

Members of the Committee on Large Plastics Moldings and the Society of Industrial Designers have set April 15 as the date for day-long panel sessions on these new applications of plastics. Co-chairmen of the conference are Jean O. Reinecke, president of the Society of Industrial Designers, and John Bachner, chairman of the Committee on Large Plastics Moldings. Panel discussions will be moderated by Hiram McCann, editor of MODERN PLASTICS, and Julien Elfenbein, editorial director of home furnishings group, Haire Publishing Co., Inc.

Styrene Price Reduction

ANNOUNCEMENT of a four-cent price reduction on Styron 475 has been made by The Dow Chemical Co., Midland, Mich.

The company's high impact polystyrene plastic is now 37¢ per lb. on any quantity of standard colors. A price reduction was also made on special colors, with price dependent upon quantity ordered.

Container Patent Upheld

THE United States District Court, Northern District of Illinois, Eastern Div., in the patent infringement suit of Tupper Corp., plaintiff v. Republic Molding Corp., defendant, has held U. S. Patent No. 2,487,400 to be valid and infringed by defendant. Republic Molding Corp. has now been licensed by Tupper Corp. to

Medium Impact LUSTREX Styrene

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Lustrex LHA has *twice* the impact strength of general purpose styrene, *high gloss* and beautiful surface finish, good heat resistance and excellent moldability. Its greater toughness reduces breakage in the plant and in shipment which means extra savings for the molder.

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manufacture and sell a limited number of items under said patent.

The Tupper patents pertain particularly to the seal which is an important feature of all Tupperware polyethylene molded containers.

What About 1975?

THE summation of the Government's Materials Policy Commission report on the production of synthetic organic chemicals for the next 25 years has been prepared and is available at no cost from R. S. Aries & Associates, 400 Madison Ave., New York, N. Y.

Production of Plastics in Millions of Pounds

	1950	*1955*	*1975*
Phenolics	451	850-930	4510
Polystyrene	261	350	715
Styrene copolymers	94	540	2835
Others—benzenoids	145	310-380	3410-5410
Urea and melamine	219	265	570
Vinyl	381	700	2000
Polyethylene	55	200	1000
Others—non-benzenoid	211	220	550
Cellulosics	130	135	175

According to the Aries organization, the Government report can be summarized for plastics as in the accompanying tabulation.

Another Vinyl

INTRODUCTION of the newest product in the series of Pliovic polyvinyl chloride resins has been announced by Goodyear Tire & Rubber Co.'s Chemical Div., Akron, Ohio. Designated Pliovic G80V, the new resin is described by H. R. Thies, division manager, as a general purpose, straight vinyl material having an approximate intrinsic viscosity of 0.80. It is designed to complement the use of the previously announced Pliovic G90V in calendering, coating, and extruding operations.

Mr. Thies stated that because its intrinsic viscosity is lower than that of G90V, the new product's processing temperature requirements are 20 to 40° F. lower than those of G90V. Thermal stability of the new product is said to be comparable to G90V. This, combined with lower fusing temperatures, permits more rapid calendering and extrusion. Both clear and pigmented products are said to benefit from the resin's excellent light stability and good color.

Dimethyl Isophthalate

COMMERCIAL production of dimethyl isophthalate has been announced by Hercules Powder Co. The material is claimed to have advantages over phthalic anhydride in the preparation of plasticizers, alkyds, and polymers, but heretofore has never been available in any quantity or price that would permit commercial use.

Company officials assert that the new material will make possible plasticizers with improved low-temperature efficiency and lower volatility, and that it will give improved toughness in laminating resins. The present plant will have an ultimate capacity of 200,000 pounds.

Another product which is being made concurrently in the Burlington, N. J., pilot plant is dimethyl terephthalate—a raw material for fiber- and film-forming polyesters. It is believed possible that materials similar to the present polyester fabric and film now on the market can be made from this new Hercules material.

Better Silicones

HIGHER dielectric life for electrical insulating materials has been built into the silicone resins developed by Dow Corning Corp., Midland, Mich.

One of the materials is Silicone Varnish 994 which is declared to be the most heat resistant silicone electrical insulating varnish available. It is primarily used for coating glass cloth and sleeving and bonding mica-glass combinations.

In most cases, a cure of one hour at 482° F. produces a flexible film that is heat stable and water repellent. Coatings on aluminum panels have shown that at 482° F., the 994 coatings had a flex life of over 1000 hours and a craze life of over 3000 hours. At 572° F., flex life was greater than 500 hours and craze life was over 800 hours.

The other new material is Silicone Adhesive 40C which is used to bond the ends of either varnished or unvarnished glass electrical tapes used in coil wrapping. It has also been used as a moisture resistant seal and saturant, and is effective as a seal for heating elements in flat irons, stoves, and hot water heaters. Adhesive 40C should be air dried and baked for one hour at 212° F.

Lacquer for Plastisols

A NEW lacquer for coating or decorating vinyls and plastisols has been introduced to the plastics industry by Schwartz Chemical Co., Inc., 326 W. 70th St., New York, N.Y. The non-toxic, washable coating, called Vinaplas-Lac, was developed at the request of manufacturers of vinyl toys and dolls' heads, according to the company. Features of the fast-drying lacquer are high gloss and excellent adhesion. The coating air-dries in five minutes and leaves a flexible, scratch-proof coating.

Vinaplas-Lac is available in a wide range of colors, packed in one- and five-gal. cans and 55-gal. steel drums.

Polyethylene Adhesive

ANNOUNCEMENT of a new adhesive, Poly-Grip, has been made by Adhesive Products Corp., 1660 Boone Ave., New York, N.Y. The adhesive will adhere ordinary paper labels to polyethylene squeeze bottles and containers. Squeeze bottles are customarily stenciled or silk-screened, a process which is considerably more expensive than labeling.

Another Polymeric Plasticizer

DEVELOPMENT of a new polymeric vinyl plasticizer, Paraplex G-53, which will resist extraction by common oils, gasoline, hot soapy water, and detergents, far more successfully than most vinyl plasticizers, except for Paraplex G-25, has been announced by Rohm & Haas Co., Philadelphia, Pa.

Available at a moderate price, it is said to have good-to-excellent resistance to migration into rubbing

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varnish, automotive lacquer, furniture lacquer, Plexiglas, and polystyrene. Laboratory comparisons of milling properties indicate that Paraplex G-53 possesses processing properties superior to most polymeric plasticizers.

Paraplex G-53 is recommended for the following types of applications: vinyl refrigerator gaskets; tapes; high-temperature resistant insulations; baby wear; hospital sheeting; upholstery stocks; hose; and tubing. Its physical properties are given as: color (Gardner Varnish Scale), 8 max., acid number, 2.0 max.; viscosity (Gardner-Holdt Scale, 25° C), Z_1-Z_5; specific gravity (25° C), 1.1015; and solidification temperature, approximately 10° C.

S.P.E. Executive Secretary

THE national president of the Society of Plastics Engineers, Inc., Mr. Walter Oelman, Standard Molding Corp., 1517 E. Third St., Dayton, Ohio, announces that the position of executive secretary for the national organization is now vacant and that the Society is seeking a man for the job. He states that this position will require a man with good educational background, skill in running organizations, and preferably with experience in one or more phases of the plastics field.

Design Clinic

THE set-up of a new design clinic that will help home furnishings manufacturers with plastics design problems has been announced by Forrest Process & Development Corp., 320 Fifth Ave., New York, N. Y. The new division will be supervised by Norman Forrest, a creator of three-dimensional, deeply molded designs in flexible vinyl.

Edward Walton, president, states that the clinic can protect manufacturers of plastic upholstery by providing them with exclusive patterns in their own fields.

Gag for Snorers

THANKS to "miracle" plastics, there should be no more divorces granted to wives because of snoring husbands—or vice versa. A plastic gag to be inserted in the mouth at bedtime to prevent snoring has been invented by Elsa L. Peppich of Seattle, Wash. If you wear it, you either breathe through your nose or not at all. It is a plastic sheet, oval in shape, but narrow in the middle where it fits under the nose. The patent number is 2,627,268.

We refrain from mentioning the particular kind of plastic that is used, for fear that too many a wife would be tempted to infringe on the patent by cutting a hunk of film from her drapes or plastic refrigerator equipment and make snore gags for her miscreant spouse.

CMC Soil Conditioners

NEW soil conditioners for home gardeners, based on a special type of CMC, will be available this spring. Preliminary research data indicate that CMC is of value in conditioning problem soils such as clay or high-clay content soils that crust badly.

Soil conditioners based on CMC are expected to be available from several different companies. CMC, a cellulose derivative, is manufactured by Hercules Powder Co., Wilmington, Del.

Foundry Resin

DEVELOPMENT of a new resin, Lustrex 886, which eliminates clay balls from foundry sand and makes possible the production of truer, cleaner, and more economical castings, is announced by Monsanto Chemical Co.'s Plastics Div., Springfield, Mass.

Edmond S. Bauer, sales manager for industrial resins, stated that extensive foundry tests have shown that the new material improves sand workability, flowability, and packability. This permits uniform packing which eliminates most of the cracks, fissures, and soft spots characterizing untreated sands. Smoother mold surfaces, truer castings, and sharp reductions in costly clean-up time result. Pointing out that Lustrex 886 is effective even in small concentration, Mr. Bauer said: "One pound of the new material produces uniform clay distribution in one ton of foundry sand."

Mr. Bauer indicated that initially the new material will sell for $1.10 per pound. He pointed out, however, that only about one-sixteenth of the resin is burned out each time the sand is used. This means that only one-sixteenth of a pound of Lustrex 886 must be added to a ton of sand each time it is recycled.

Electronics Casting Resin

ANNOUNCEMENT of a new casting resin, Aritemp, which will permit increased application of the technique of embedding and encapsulating or potting of electronic components and circuit assemblies has been made by R. S. Aries & Assoc.

Approximately 1 million lb. of resins are already used annually for this purpose; the projected use by 1956 is several times that amount. One of the difficulties so far has been that the resins used for potting have not been able to preserve their characteristics at elevated temperatures.

The new resin retains its excellent electrical properties from −60° to +200° C. It is further characterized by its superior adhesion to metals and its resistance to moisture vapor transmission. Aritemp is being offered as a single component system, eliminating the necessity of formulating on the part of the user prior to pouring.

Aritemp resins will be sold through authorized manufacturing licensees of R. S. Aries. Information and detailed data sheets are available from the company located at 400 Madison Ave., New York, N. Y.

Design Contest

AN international design contest to encourage original and fresh design ideas in the manufacture of plastics fabric has been launched by Flexton Corp. As the company's president, Fred Weiswasser, says: "The plastics industry should refrain from imitation and encourage new design ideas. We shall sponsor this international competition each year to ferret out original thinking in plastics design."

The competition is divided into a national and an international section. The awards will be made in the early fall on accepted entries,

This processing setup was developed several years ago by Farrel-Birmingham engineers, working with plastics manufacturers, to synchronize the progressive steps in the production of calendered plastic film and coatings.

Since then, many installations have been made in plastics plants. In fact, the combination has been giving such satisfactory service that it has become the generally accepted unit for this type of production.

Using this setup, one manufacturer has been able to produce, for the first time on a commercial scale, 1.7 gauge, calendered, unsupported vinyl film. The variation in accuracy of gauge of the final product is less than plus or minus .0001 inch.

Farrel-Birmingham engineers will be glad to help you select individual machines or combination units best suited to your specific requirements. Send for further information.

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which must be submitted by June 15, 1953. Awards will be made for the three outstanding designs submitted from within the United States and its possessions; and three awards will be granted to winning designs submitted from foreign countries. First prize in both sections will be $250; second, $150; and third, $100, plus royalties on all fabric produced which incorporates the winning designs.

Designs may be submitted on paper, wood, fabric, tile, plastics sheeting, metal, or glass in dimensions no less than 12 by 12 inches. They may be in one color or in a full range of colors. Surface texture will be considered in the final judging.

All designs must be accompanied by an entry form which may be obtained from Flexton Corp., First International Plastic Design Competition, 307 Fifth Ave., New York, N. Y.

Phthalic Anhydride

MORE than 85% of today's consumption of phthalic anhydride is used for alkyd and vinyl resins, according to James E. Sayre, chemical marketing specialist on the staff of Barrett Div., Allied Chemical & Dye Corp. Present growth conditions indicate that these two resins will each use from 12 to 15 million lb. more phthalic anhydride per year, with polyesters perhaps moving into the field for large-scale supplies at some time in the future. Mr. Sayre also pointed out that some estimators say 30 million lb. increases per year could be absorbed by the total phthalic market. About 275 million lb. were available in 1952, and if the present program is carried out, about 375 million lb. will be available by the end of 1954.

A complete report of Mr. Sayre's study may be obtained from the Barrett Div., 40 Rector St., New York 6, N. Y.

Insulating Varnish

ELECTRICAL insulating varnish, designed especially for equipment where high speeds and/or intense vibration normally would cause wire movement and resultant electrical failures, has been developed by Irvington Varnish and Insulator Co., Irvington, N.J. Known as Irvington #140, the mechanical strength of this new varnish is outstanding even at Class B temperatures.

The manufacturer has prepared a technical data sheet on Irvington #140 varnish, a copy of which can be obtained from Irvington's Sales Promotion Department.

Citrazinic Acid

TRIAL quantities of citrazinic acid, a poly-functional pyridine compound, are offered to the pharmaceutical, dyestuff, agricultural chemical, plastics, metal treatment, graphic arts, and other industries by Chas. Pfizer & Co., Inc., 630 Flushing Ave., Brooklyn, N.Y. The material, to be distributed under the name CZA, has never before been produced in quantity for commercial use.

A white-to-buff colored organic acid, the chemical is 2,6 dihydroxy-isonicotinic acid. Its molecular grouping makes possible many chemical reactions, as well as the economical synthesis of new classes of substituted pyridines.

Salvaged Bottles

REMOVAL of silk screened ink from previously printed bottles which ordinarily would be scrapped, is reported as practical by a method developed by The Deb Co., 106 Ann St., Hartford, Conn. The process leaves the bottles completely clean of ink and ready for reprinting.

California Phenolics

A PRODUCTION rate of 350,000 lb. of phenolic molding powder in December has been announced by Loven Chemical of California, Newhall, Calif. Total shipments for the year 1952 were reported as 2,263,332 lb. with a dollar value of $487,000. The company expects to increase its December production rate, which was on a single shift basis. Shell molding resins are also being produced by Loven on a small scale and expansion is expected.

The company has made an application to the Government for a certificate of necessity to erect a phenol plant.

High Boiling Phenols

FIRST product from coal hydrogenation to be offered to industry by Carbide and Carbon Chemical Co. from its new plant in W. Virginia, is high boiling phenols. This new product has a distillation range of between 230 and 270° C. It is claimed to have greater reactivity with formaldehyde in the synthesis of thermosetting resins than the phenols ordinarily used.

Fluorocarbon Plant

THE new plant for production of Kel-F fluoro-chloro-carbon plastics went on stream in March, according to Louis C. Rubin, manager of the Chemicals Mfg. Div. of The M. W. Kellogg Co., Jersey City, N.J. When in full operation, the plant will add well over a million lb. annually to the supply of Kel-F.

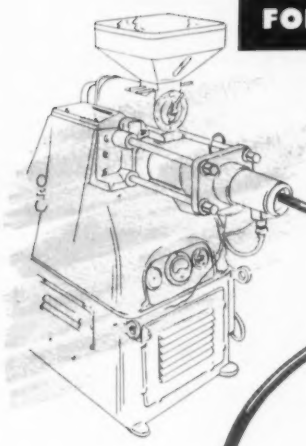
Mr. Rubin stated that while a large proportion of current production from Kellogg's initial plant is being used for military applications, the increased supply from the new plant will make Kel-F available for widespread non-military uses.

He also pointed out that a number of manufacturers have already completed development work on new products either made completely of Kel-F or incorporating this unique fluorocarbon-type plastic with metal parts or other materials. The company anticipates that the production rate of the new plant will make it possible for them to supply these customers with sufficient amounts to go ahead with their manufacturing plans.

New Plant for New Resin

A NEW plant for expanded production of Bakelite fluorothene resins is under construction at South Charleston, W. Va. H. S. Bunn, president of Bakelite Co., a Div. of Union Carbide and Carbon Corp., 30 East 42nd St., New York, N.Y., announces this continuous process plant is expected to be completed by the middle of 1953 and will be operated by Carbide and Carbon Chemicals Co., also a Div. of Union Carbide and Carbon.

The Bakelite Co. will handle the sales of fluorothene resins. At pres-



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ent the price per pound for fluorothene is about the highest known for a commercially available plastic —ranging from $11 to $15 per lb. in ton quantities up to $17.45 for a single pound.

Stronger Glass

NOW available on the market is a new Du Pont chemical called Volan, methacrylato chromic chloride, which has helped to double the wet strength of laminated structures made with fibrous glass and polyester resin. It is claimed that Volan applied to glass prior to resin impregnation has produced laminates with nearly twice the wet strength of laminates made with untreated glass fabric. Fifteen cents worth of this material, it is reported, will treat about 7 lb. of glass fabric.

In addition to glass polyester combinations, Volan has been used with zein and polyamid materials and can be combined with most of the unsaturated polymerizable materials such as allyl or methacryl monomers, and drying oils, which are polymerized by peroxide catalysts. Many bonding problems can be solved by using Volan because of its effectiveness where there is little normal adhesion between plastic and reinforcing fiber.

EXPANSION

Catalin Corp. of America, 1 Park Ave., New York, N. Y., has purchased the land and buildings at Fords, N. J., which it previously had been operating under lease agreement from Heyden Chemical Corp. The property acquired comprises approximately 19 acres of land and two of the six buildings on the site, the remaining four buildings having been constructed by Catalin during the period of its tenancy. Acquisition of the Fords acreage and buildings gives Catalin ownership of all three of its manufacturing sites, the others being located at Calumet City, Ill., and Thomasville (near High Point), N. C.

F. J. Stokes Machine Co., 5500 Tabor Rd., Philadelphia, Pa., has opened a new laboratory providing complete facilities for testing and developing materials, equipment, and processes for its customers. The new facilities, occupying about 2800 sq. ft. of floor space, represent an investment of over $150,000. The company has installed extrusion, molding, preforming, and compacting presses used in the plastics, ceramics, and powder metallurgy industries. New dies and accessories, improved methods, experimental powdered metal mixtures, and plastics compounds will undergo trial runs in this section of the laboratory.

Dr. Earl W. Flosdorf, director of research and development, and his two assistants, **Joseph F. Piotrowski** and **William H. Hamilton,** will carry on the laboratory's work.

Plexolite Corp., manufacturers of translucent fibrous glass-plastic decorative and structural panels, announces plans for the construction of a factory on a site recently purchased in the Los Angeles International Airport district on Maple Ave., nr. Sepulveda Blvd., El Segundo, Calif. The new plant will represent an investment of about $250,000.

Plexolite, in addition to its present manufacturing process, plans to produce its own fibrous glass mat as well. The present offices at 4223 W. Jefferson Blvd., Los Angeles, will be taken over by Plexolite Sales Co., general distributors.

The Marine Plastics, Inc., Leominster, Mass., has moved its main plant to 21 Depot Sq., Clinton, Mass., a four-story building providing over 45,000 sq. ft. of working space. The Leominster plant will become the branch factory, specializing in the reworking of scrap material.

Steiner Plastics Mfg. Co., Inc. announces the completion of its new plant at Bay Ave., Oyster Bay, N. Y., to be devoted to molding and fabrication of reinforced plastics. The main office will remain at Pratt Oval, Glen Cove, N. Y.

Yates Co., Erie, Pa., announces plans for immediate expansion to offer wider service on extruded plastics. Greater production of extruded special plastic shapes, rods, tubes, and strips on a custom basis will be possible in approximately double the area presently utilized.

General Electric Co. announces that its Chemical Div.'s new $5 million silicone plant at Waterford, N. Y., is now in operation. This expansion and planned larger facilities will ready G-E for an expected tenfold increase in silicone products by 1960. Demand for silicone rubber alone has trebled in the past two years. Coincident with expansion of processing equipment, laboratory services have been doubled, and employment is up 50% from a year ago.

COMPANY NOTES

Monsanto Chemical Co.'s Plastics Div. announces the additions of **Ralph E. Hammer** and **Robert R. Moyer** to its sales department. They have been assigned to technical service for thermoplastic molding materials. Mr. Hammer was formerly a materials engineer in the plastics department of General Electric Co., Pittsfield, Mass., and Mr. Moyer was affiliated with the plastics division of Continental Can Co., Cambridge, Ohio.

American Resinous Chemicals Corp. and **American Polymer Corp.,** Peabody, Mass., announce the appointment of **Schibley Solvents & Chemicals Co.,** 1940 E. Sixth St., Cleveland, Ohio, as sales agents in Ohio.

General Electric Co.'s Chemical Div. announces the following appointments: **Harold M. Patterson** is now manager of engineering of the plastics department. He has been with the company for 24 years as product and manufacturing engineer at the division's former Meriden, Conn., plant. From 1944 to 1947, Mr. Patterson managed G-E's molding plant at Taunton, Mass. **John P. Donohue** has been made manager of the financial department, succeeding **Harold P. Smith** who moved to an administrative post at G-E aircraft gas turbine division at Cincinnati, Ohio. **C. L. Chase** has been promoted to sales development supervisor for phenolic resins and varnishes. He will be responsible for the commercial development of G-E laminating, industrial, and foundry resins. **Haines V. Reichel,** supervisor of customer service for the laminated

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2 **TRANSPORTATION**—Site is bisected by New York, New Haven and Hartford Railroad. Superb service also furnished by Boston and Maine Railroad. Over 200 trucking companies offer service to all points. 24 miles to Boston's air and seaport facilities.

3 **LABOR SUPPLY**—Workers of diverse basic skills earn over $10.00 less than the U.S. average weekly wage and are deeply attached to the community.

4 **LOW COST AREA**—In a survey Lowell was 38th in 38 cities surveyed for cost of housing and 25th of 38 cities surveyed for food costs.

5 **TECHNICAL RESOURCES**—Facilities of Lowell Technological Institute available for your industrial research. Close proximity to M.I.T., the greatest plastics research center in the world.

6 **UTILITIES**—All on premises. Abundant water, electric power and low cost natural gas.

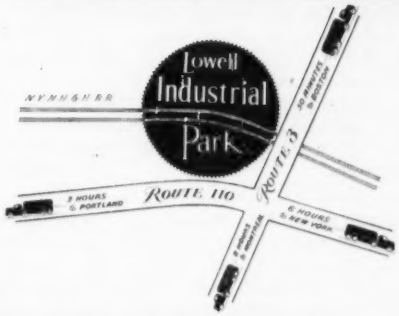
OTHER INDUSTRIAL SITES—Choice of 35 industrial sites selected and approved by experts in the Greater Lowell area. 5 acres to 400 acres.

The Executive Director of the Lowell Development and Industrial Commission is available to meet with you or your representatives and furnish information of the type you require in confidence.

LOWELL, MASSACHUSETTS, the big-city industrial center of a cluster of small New England towns, offers every metropolitan advantage together with low production costs made possible by country living. Here, only 2 miles from the center of Lowell, but with ample room for parking and expansion, local capital has selected a 110 acre park and built a modern 42,000 square foot plant as the first step in intensive industrial development. This plant (illustrated) is ideally suited to horizontal plastics manufacturing, and is ready for you now. It has concrete floor, 14' stud and 35' x 40' bays, steel roof, trucking facilities at floor level, railroad siding, sprinklers throughout, fluorescent lighting throughout, handsome modern design and quick accessibility to metropolitan Lowell.

Any portion of the 110 acre park will be conveyed almost at cost, provided a new industrial building is promptly built.

Long an industrial center, Lowell possesses well developed technical resources and a reservoir of skilled artisans whose deep attachment to the community makes them hard to lure elsewhere.



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and insulating products department at Coshocton, Ohio, will service orders and handle inquiries concerning Textolite plastics surfacing, industrial laminated products, and G-E mica mat insulation.

Jensen Specialties, Inc., 9331 Freeland, Detroit, Mich., has named **Burtron Zook** sales manager of the company's line of industrial ovens and heating equipment.

Elastomer Chemical Corp. has moved to larger quarters located at 212 Wright St., Newark, N. J. Increasing demands for foamed plastisol based on vinyl resins created the need for expanded facilities.

The Renier Co., Inc., 5209 Euclid Ave., Cleveland, Ohio, has been established to handle the complete design of machine tools, hydraulic presses and equipment, and specialized machinery of all types. The company is headed by **William S. Renier**, formerly director of engineering of **Hydraulic Press Mfg. Co.**, and manager of the plastics division of **Giddings & Lewis Machine Tool Co.**

Rex Corp., West Acton, Mass., announces the appointment of **John A. Crowe** as assistant to the president in charge of sales and sales promotion.

Celanese Corp. of America, 180 Madison Ave., New York, N. Y., announces that **H. B. Bartley, Jr., N. G. Baker**, and **M. Henry Jamison** have joined the sales staff of the company's Chemical Div. Mr. Bartley, who was with the company before a tour of duty with the Chemical Corps, and Mr. Baker, formerly with **Enjay Co.**, are assigned to the New York office. Mr. Jamison, previously with Dearborn Chemical Co., is at the Chicago office.

Baker Castor Oil Co. announces the appointment of **John Ottens** as a sales representative in the Chicago office, 105 W. Adams St. Mr. Ottens was formerly associated with **Universal Oil Products, Witco Chemical Co.**, and **Carl A. Lechner Co.**

American Lucoflex, Inc., which recently moved its New York offices to 500 Fifth Ave., has appointed **Edward M. Webster & Co.**, 453 Aberdeen Ave., Hamilton, Ontario, as Canadian distributor for Lucoflex rigid vinyl materials, according to **Dr. M. J. Pagerie**, who is now vice president and general sales manager of American Lucoflex.

B. F. Goodrich Chemical Co., Rose Bldg., Cleveland, Ohio, announces that **M. W. Osborne, Jr.**, formerly advertising manager, has been named international sales manager. He succeeds **O. E. Isenburg**, who is now sales manager of Harmon Colors. **George B. Koch** is now advertising manager and **J. S. Wolff**, former Washington representative, succeeds Mr. Koch as agricultural chemical staff representative in Cleveland.

American Ultrasonics Co., 198 Pacific St., Newark, N. J., is now marketing a reputedly "revolutionary" machine for emulsifying chemicals or other materials by the use of ultrasonic waves.

The Dynakon Corp. has moved to larger quarters at 9623 Clinton Rd., Cleveland, Ohio.

F. J. Stokes Machine Co. has appointed **L. E. Ritter** as sales engineer in charge of the company's new office at 1133 Brentwood Blvd., St. Louis, Mo.

Federal Tool Corp., 3600 W. Pratt Blvd., Chicago, Ill., has named **J. O. Reinecke & Associates**, 720 N. Michigan St., Chicago, as product design counsel.

Synthane Corp., Oaks, Pa., has appointed **Robert S. McCreadie** sales engineer. Formerly a development engineer at **General Electric Co.**, Mr. McCreadie has done research and experimental work with plastics, particularly in the field of printed circuitry.

Ciba Co., Inc., has set up a sales and technical unit at 325 W. Huron St., Chicago, Ill. **Joseph B. Durra** heads the unit.

Alsynite Co. of America, San Diego, Calif., and Portsmouth, Ohio, announces the following changes: The company's export division has moved from White Plains, N. Y., to 11 W. 42nd St., New York, N. Y. **George V. W. Burton**, formerly Southeastern district manager, has been assigned to the new post of Eastern regional sales manager, operating from the New York office. **Elwood E. Zerbe** succeeds Mr. Burton and will direct sales operation in 13 states from 267 E. Paces Ferry Rd., Atlanta, Ga.

Irvington Varnish and Insulator Co.'s Fibron Div., Irvington, N. J., announces the following appointments: **Gordon C. Brown**, formerly sales manager, has been promoted to vice president of the company and general manager of the Fibron Div.; **Bernard M. Hoey** is now sales manager of the division.

Emeloid Co., Hillside, N. J., which was organized in 1919 and is still under the same management, has recently promoted three of its employees to the following offices: **William Lowney**, vice president in charge of production; **Robert W. Madan**, vice president in charge of specially made articles; and **Jackson S. Freundlich**, vice president in charge of advertising specialties. **Joseph Dassing**, formerly of **Penn Arts Co.**, Philadelphia, Pa., is now assistant to the superintendent and **George Emerson**, who was in charge of sales at Penn Arts, is now also with Emeloid in a similar capacity.

In addition to fabricating and lithographing on plastics, the company has expanded its facilities for vacuum-forming equipment.

Bassons Industries Corp., 1432 W. Farms Rd., New York, N. Y., has copyrighted the name "Plastrong" to designate its reinforced plastics products.

The company also announces that **Walter Greenberg** has joined the chemical engineering staff and will assist **George Lubin**, director of research.

Tri-State Plastic Molding Co., Henderson, Ky., will embark this spring on its first consumer advertising campaign for its line of plastics housewares. Tri-State-Ware and Freez-R-Ware will be featured in various women and farm magazines.

National Plastic Products Co., Odenton, Md., has won the National Commander's Award of the Disabled American Veterans for hiring and making effective use of handicapped

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Efficient handling and shipping in modern stainless steel tank trucks assure prompt delivery of pure, uncontaminated Barrett Dibutyl Phthalate and *ELASTEX*® 28-P (DOP) Plasticizers.

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veterans. The award was accepted by **Ephraim Winer**, president of National Plastic Products.

Flek Corp., 2252 E. 37th St., Los Angeles, Calif., specializing in the molding of fluorochlorocarbon thermoplastics, has appointed **Harry Neuwirth** as sales engineer to cover the metropolitan area in Los Angeles.

Donovan Industries, Inc., 47 W. 34th St., New York, N. Y., is a new company set up to service the shoe and allied industries. The organization will act as national distributor and representative for domestic and foreign tanneries and for manufacturers of textiles, plastics, and other materials used by the shoe and allied industries.

Taco West Corp., 525 N. Noble St., Chicago, Ill., has appointed **Control Equipment Co.**, Atlanta, Ga., to represent Taco West in Georgia, eastern Tennessee, Alabama, and northern Florida. Taco West manufactures pyrometric temperature control instruments which are used primarily for precision control of plastics molding machines, extruders, furnaces, ovens, and kilns.

Cowan Boyden Corp., 50 Aleppo St., Providence, R. I., announces that **Howard C. Boyden** is no longer connected with the organization and that his interests have been taken over by **C. J. Cowan**, president, and his associates.

Metro-Atlantic, Inc., Centredale, R. I., has assigned **Robert H. Carlson** to its sales staff to cover parts of southern New England.

Emery Industries, Inc., Cincinnati 2, Ohio, announces the appointment of **John D. Farr** to the development and service department. He will be connected with all development and technical service activities pertaining to Emery's Plastolein plasticizers. Mr. Farr was formerly associated with **B. F. Goodrich Co.**

Manco Products, Inc., Melvindale, Mich., has appointed **Joseph P. Healy**, vice president, as general sales manager. He will handle all sales in the United States, Canada, and foreign countries, and will have his headquarters in Buffalo, N. Y. Mano produces Tru-Cast beryllium copper cavities and cores.

Canadian Resins & Chemicals, Ltd., 600 Dorchester St., West, Montreal, Quebec, has appointed **Walter E. Smith** to the newly-created post of manager of development. **Dr. R. E. Hughes** succeeds Mr. Smith as director of laboratories.

Worcester Moulded Plastics Co., 14 Hygeia St., Worcester, Mass., announces the following appointments: **William C. Bradford**, formerly production manager, has been appointed manager of the New York district sales office; **Bertram E. Graham**, superintendent of the company for 13 years, is now works manager of the plant in Worcester and will be assisted by **Anthony P. Beaudry**. **John I. Graham** succeeds Bertram E. Graham as superintendent. Worcester has opened a sales office in Mansfield, Ohio, to be headed by **Rexford Beal.**

Marbon Corp., 1926 W. Tenth Ave., Gary, Ind., announces that **Bronis de Supinski** has joined the laboratory staff as assistant chief chemist, and **W. H. Cornell** as group leader of product development. Mr. de Supinski was formerly associated with Congoleum Nairn and Glenn L. Martin Co., where he was active in polymerization and application work on vinyl resins. Mr. Cornell will be engaged in the development of adhesives and applications for new resins.

Imperial Chemical Industries Limited of Great Britain has appointed **J. B. Henriques, Inc.**, 521 Fifth Ave., New York, N. Y., to handle its sales of plastics in the United States.

Heyden Chemical Corp., 342 Madison Ave., New York, N. Y., has appointed **Scotty Neader** as sales representative, assigned to the Chicago district sales office at 20 No. Wacker Drive.

Logo, Inc., 13799 S. Avenue O, Chicago, Ill., **Div. of Bee Chemical Co.**, announces the following promotions: **Richard E. Dunning**, former production superintendent, is now factory manager; **Richard E. Jarzombek**, technical sales representative, has been named manager of sales service.

Structurlite Plastics Corp., Hebron, Ohio, has recently engaged **Steel Mill Products, Inc.**, 176 W. Adams St., Chicago, Ill., as its exclusive sales agent in Indiana, Illinois, Iowa, Wisconsin, Minnesota, and Michigan.

Witco Chemical Co., 260 Madison Ave., New York, N. Y., announces that **John H. Wishnick**, manager of the Chicago plant, is now in charge of chemical manufacturing at the Chicago and Brooklyn plants. He will operate from the New York office. **Joseph Tumpeer**, sales manager of the asphalt division, has assumed charge of the manufacturing operations at Lawrenceville, Ill., and Perth Amboy, N. J.

Improved Paper Machinery Corp. has changed its name to **Improved Machinery Inc.** The trade name, Impco, will continue on all products. The Plastic Molding Div. of the company is represented by **George W. Whitehead**, sales manager. The company sales offices for plastic molding equipment will remain at Nashua, N. H.

Advance Solvents & Chemical Corp., 245 Fifth Ave., New York, N. Y., announces the appointment of **Wayne F. Anderson** as representative for rubber and plastics chemicals in northern Ohio, with offices at 547 Aqueduct St., Akron. Prior to the formation of his own sales organization, Mr. Anderson served as sales representative for B. F. Goodrich Chemical Co.

PERSONAL

Harald J. Torgesen has joined Gladwin Plastics, Inc., 275 Houston St., N. E., Atlanta, Ga., as assistant manager in charge of product and sales development.

M. W. Gaylord has been appointed assistant manager of the Research Administration Section of the Research Dept. of **Koppers Co., Inc.** Mr. Gaylord's headquarters will be at the Verona, Pa., Research Center of Koppers Research Department.

Carroll B. Dick has been appointed manager of **Westinghouse Electric Corp.'s Micarta Div.**, succeeding **E. R. Perry** who has resigned. He

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will be in charge of the Micarta Div. plant at Trafford, Pa., and **Plywoods-Plastics Corp.**, Hampton, S. C., a Westinghouse subsidiary. Mr. Dick joined the company in 1918 and was previously works manager of the Westinghouse Electric Appliance Div. plant at East Springfield, Mass.

Clair Jay Terrill, chief engineer and general manager of **Harry Davies Molding Co.**, 1428 N. Wells St., Chicago, Ill., for the past 16 years, has retired. He has been in the molding business since 1910.

James H. Watt has been named branch manager of plastics sales of **Monsanto Chemical Co.'s Western Div.**, Los Angeles, Calif. Mr. Watt, has been assistant branch manager of the Los Angeles office since 1947.

Max A. Minnig, vice president and national sales manager of rubber chemicals of **Witco Chemical Co.**, 260 Madison Ave., New York, N. Y., has been made director of sales for the company.

W. R. T. Crolius has been appointed market analyst of **Plax Corp.**, West Hartford, Conn.

Keith H. Williams has joined the Chicago office of **The Dow Chemical Co.** as a plastics molding powders salesman for that area.

Robson G. Head is now sales manager of the **Plastics and Resins Div. of North American Cyanamid Ltd.**

H. S. Riggs has joined **Plastic Molders Supply Co., Inc.**, Plainfield, N. J., as sales representative for the company's Massachusetts and Rhode Island territory. His headquarters will be at 16 Norwich St., Worcester, Mass.

J. Walter Mills has been named sales manager of **Rogers Plastic Corp.**, West Warren, Mass. He was formerly with **Monsanto Chemical Co.**

W. A. King has been appointed regional sales manager of the plastics department of **American Cyanamid Co.'s** Midwest territory. He will be responsible for sales and technical service for the company's melamine and urea molding materials, and laminating, polyesters, industrial, and general purpose resins. Before joining American Cyanamid in 1940, Mr. King was with the **Barrett Div., Allied Chemical & Dye Corp.**, where he specialized in research and development on thermoplastics.

Jack H. Waggoner is now technical assistant to the general manager of **Pittsburgh Plate Glass Co.'s Fiber Glass Div.**, Pittsburgh, Pa. During the past seven years, he has served as technical assistant to the executive vice president of **Owens-Corning.**

Eugene R. Perry has been named vice president, director, and general manager of **National Vulcanized Fibre Co.**, Wilmington, Del., and its subsidiaries. Until recently, he had been manager of the **Micarta Div., Westinghouse Electric Corp., Trafford, Pa.**

Prof. Leo Brewer of the University of California, an authority on high-temperature chemistry and a consultant to the Atomic Energy Commission, has been chosen to receive the 1953 Leo Hendrik Baekeland Award of the American Chemical Society's North Jersey Section. The award, which consists of $1000 and a gold medal, will be presented to Dr. Brewer at a dinner meeting of the North Jersey Section at the Essex House, Newark, on April 27.

Alan F. Shepardson, who was connected with the Plastics Section of WPB during World War II and who has spent several years in Germany, has been named a synthetic resin and plastics consultant to the **Snyder Chemical Corp.**, Bethel, Conn. He will maintain his present location at 14 Hull Ave., Pittsfield, Mass.

Charles H. Groff has been named technical director of **The Watson-Standard Co.**, Pittsburgh, Pa.

Paul R. Hofmann has been named sales manager of the newly established **Wall Covering Div., Bolta Product Sales, Inc.**, Lawrence, Mass. Mr. Hofmann will make his headquarters at 10 W. 33rd St., New York, N. Y., and will supervise all sales activities of wall coverings. He was formerly sales manager of the plastic wall covering division of **United States Plywood Corp.**

Charles W. Smith is now works manager of **Borden Co.'s Chemical Div.** plant at Bainbridge, N. Y. He is the son of **J. C. Smith**, who is a well-known pioneer in the plastics industry. Borden's Bainbridge plant produces synthetic resins and adhesives, manufactured caseins, small package glues, and formaldehyde.

Frank E. Golliher is now manager of **General Electric Co.'s** plastics molding plant at Decatur, Ill. He has been associated with G-E since 1931.

A. T. Fiore has been named coordinator of New Product Development and Service Laboratories of **Givaudan-Delawanna, Inc.**, 330 W. 42nd St., New York, N. Y., and its affiliate, **Sindar Corp.**

DECEASED

William F. Roberts, manager of **Monsanto Chemical Co.'s Plastics Div.** sales office at Los Angeles, Calif., died on January 23. He had been with the company since 1925.

William Grote, chairman of the Board of Directors of **Grote Mfg. Co.** and **Grotelite Co.**, Cincinnati, Ohio, died on January 16.

MEETINGS

April 8-10—Society of the Plastics industry, Pacific Coast Section Conference, Last Frontier Hotel, Las Vegas, Nevada.

April 21—Association of Consulting Chemists & Chemical Engineers, Inc. Symposium, Hotel Belmont Plaza, New York, N. Y.

April 26-29—American Institute of Chemical Engineers, Royal York Hotel, Toronto, Ontario.

May 9-15—Society of the Plastics Industry, Annual Meeting and Conference, Cruise to Bermuda.

May 20-22—Society for Experimental Stress Analysis, Spring Meeting, Hotel Schroeder, Milwaukee, Wis.

S.P.E. Meeting

April 8—Norman Waldman, Consultant, will address the Newark Section on "Prehardened Steels" at the Military Park Hotel, Newark, N. J.

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FOR SALE MODERN HYDRAULIC PRESSES. 1—1000 ton H.P.M., hydro power, 68" clear between posts side to side 36" front to back, 15" opening and stroke. Can be increased with new bolts. Is complete with 25 H.P. oil pump, reservoir, and all controls. Extra heavy, minimum deflection, weighs 85,000 pounds; 1—750 ton, same as above, except 12" opening and stroke. Complete with oil pumping unit, reservoir, etc. Will rework within their range to suit. Drawings available; 2—500 ton upmoving presses, 52" clear side to side, 36" front to back, 12" stroke, 24" opening, rapid traverse, complete with individual pump unit. Very modern. Built for Plastic Molding. STEWART BOLLING & CO., 3190 East 65th Street, Cleveland 27, Ohio.

ONE-CLEARING, 500 TONS, completely self-contained with controls for manual or automatic operation, suitable for compression and injection molding; 1—Farrell, 300 Tons, 48" x 48" steam platens, 2 openings, 4 rams—10" diam. x 20" stroke, approx. 15" per opening; 1—Loomis (New), 340 Tons, down-acting, 56" x 24" steam platens, 2 rams—12" diam. x 16" stroke, adjustable DLO 2½" to 20½"; 1—Watson-Stillman, 160 Tons, 11¾" x 12" platens, 22½ DLO, ram—8" dia. x 15" stroke; 1—Watson-Stillman, 100 Tons, self-contained, complete with Motor-driven Pump, Piping, valves and controls; 2—Burroughs, 75 Tons, down-acting, 17½" x 17" electric-heated platens, 13½" DLO, ram—8" dia. x 10" stroke, complete with 7½ HP Motor-driven Oilgear Pump, all piping, valves, controls; 1—Loomis (New), 50 Tons, down-acting, 56" x 24" electric-heated platens, 2 rams—6" diam. x 12" stroke, adjustable DLO 2½" to 20½"; 1—Watson-Stillman, 50 Tons, down-acting, platen area 25" x 25½", 25" DLO, ram—7" dia x 14" stroke, complete with 7½ HP Motor-driven pump, valves, piping, controls; 1—HPM, 25 Tons, down-acting, ram —4" dia. x 8" stroke, 18" DLO, 12" x 6" platens, self-contained with MD Pump, piping, valves and controls; Thropp 18" x 50" Mill, complete with 100 HP Motor, Drive, Controls. Good condition as Recently Removed from Service. JOHNSON MACHINERY COMPANY, 683 Frelinghuysen Avenue, Newark 5, New Jersey, Bigelow 8-2500.

FOR SALE: Quick delivery Rubber and Plastic Equipment. Farrell 16"x48", and 15"x36", 2 roll rubber mills. Other sizes up to 84". New Seco 6"x12" and 6"x16" Lab. Mixing Mills and Calenders. Rubber & Plastic Extruders. HPM 200 ton Hydr. Press 4 opening, 32"x50" platens. 200 ton Brunswick 21"x21" Platens, 14" Ram. Record Presses. Wat.-Still. 100 ton 24"x24". Elms 75 ton 30"x36". Also presses Lab. to 2000 tons from 12"x12" to 48"x48". Hydr. Oil Pumps. Gould 75 HP motor Dr. 2 stage Centrif. Pump 250# W.P. W.S. 4 Pigr. High and Low Pressure Hydr. Pump. HPM 5 GPM 2700 lbs. Elmes Hor. 4 Plgr. 4500 lbs. and 3000 lbs. Hydr. Accumulators. Stokes Automatic Molding Presses. Rotary & Single Punch Preform Tablet Machines ½" to 3". Injection Molding Machines 1 oz. to 32 oz. Baker Perkins Jacketed Mixers 100, 50, and 9 gal. Plastic Grinders. Heavy duty mixers, grinders, pulverizers, gas boilers, etc. Partial listing. We buy your surplus machinery. STEIN EQUIPMENT CO., 107-8th Street, Brooklyn, 15, N. Y., STerling 8-1944.

ONE BUNN PACKAGE-TYING MACHINE. Triple wrap ring tie for 1½" to 2½" diameter x 60" long. 1—National Rubber 2½" Extruder and Drive Unit, less motor, hopper and elbow. 1—National Rubber Drive Unit, size 2", less motor and sheaves. 2—National Rubber Drive Units, size 2½", less motor and sheave. 1—Worthington 2½", DE3 Monobloc Pump Unit, Type P.A. with 25 HP drive. Reply Box 427, MODERN PLASTICS.

SAVE WITH GUARANTEED REBUILT EQUIPMENT—RUBBER MIXING MILL, heavy duty 18"x48"; HYDRAULIC PRESSES; 28"x25", 750 ton, 18" ram. HOBBING, 26"x18", 12" main ram, TRANSFER, 170 tons; 20"x20", 10 ram 118 tons, 24"x26", 10" ram, 118 tons; 20"x20", 10" ram, 200 tons, 30"x26" 8" ram, 75 tons, 15"x15", 8" ram, 75 tons, 19"x24", 10" ram, 75 tons, 12"x12", 6½" ram, 50 tons, 14"x14", 8" ram, 50 tons, 8"x9½", 4½" ram, 20 tons, 16"x16", 3½" ram, 12 tons; LABORATORY PRESSES: Carver, model 150, 10 ton, Buehler 10"x7" 12 ton; NEW UNIVERSAL DUAL PUMPING UNITS: 3 to 15 HP; NEW LABORATORY MILLS & CALENDERS; EXTRUDERS: Royle #1 Plastic, insulating type, NRM, 4", strainer type; ACCUMULATOR HPM 6" ram, 2500#, PREFORM PRESSES all sizes, also Mixers, Vulcanizers. Injection Molding Machines, etc. UNIVERSAL HYDRAULIC MACHINERY CO., INC., 285 Hudson St., New York 13, N.Y.

FOR SALE: Reinforced Plastics Press 54" x 144". Injection Presses: 4 & 9 oz. HPM, 16 oz. Lester, 16 oz. Impco VF 822. 1 & 2 oz. Van Dorn, 4 oz. Makray. Extruders: 3½" NRM, Royle No. 1 Wire cov. unit, oil heated. Stokes-Windsor RC 100 Twinscrew. 1¼" Modern Plastics w. crosshead. Scrap grinders. Ovens. Transfer & Compression presses: 1—500 t. Compr. Press 48" x 48" Pl. 3, 12 & 50 t. Lab presses. Preform presses: Colton 5½T. Kux 25. 1—16" x 36" Rubbermill. Sheridan Emboss. press No. 4. 42" Slitting & Rewind machine. 7½ HP Varidrive. 2 HP Gas boilers. List your surplus equipment with me for prompt action. JUSTIN ZENNER, 823 Waveland Ave., Chicago 13, Ill.

PARTIAL LIST of available machines, may be inspected in operation: 48 ounce Lester, almost new. 8 ounce Hy-Mac new 1946 $6500. 2—20 ounce Lesters, 1949 & 1952. 3 ounce Hy-Mac horizontal self contained. 6 ounce Lester, 1935, $3500. 7 ounce H.P.M., 1940, $6500. 6 ounce Watson-Stillman, $4500. 6½ ounce Grotelite, $4500. 8 ounce DeMattia, 1946, $8500. 8 ounce Leominster, 1946, $7500. 3 ounce Fellows 2 years old. 6 ounce Lester, 1947. 8 ounce Reed-Prentice & Leominster cylinders $600 each. 8 ounce Reed-Prentice. 8 ounce Watson-Stillman, 1944. $7000. 12 ounce Lester, w/extra cyl., $10,000. 12 ounce Watson-Stillman, 1948. 60 ounce Jackson & Church, new 1950. 2,000 Ton Hydraulic Press. Watson-Stillman 28 ounce machine 48 ounce cyl. 12 ounce Reed-Prentice. 9 ounce H.P.M. w/12 ounce cylinder $7500. 22 ounce Impco vertical $16,000. 300 Ton Stokes Press. Reply Box 425, MODERN PLASTICS.

FOR SALE: 28 Ton WS 18"x18" Platen, 50 Ton PRESS 20"x20" Pl., 75 Ton ADAMSON PRESS 20"x20" Pl., 75 Ton WS 15"x15" Pl., 140 Ton WS 22"x17" Pl., 150 Ton HPM Triple Action 36"x36" Pl. 175 Ton HPM 30"x30", 250 Tons WS 28"x24", 300 Ton WS 20"x20", 300 Ton WS 24"x29" Platen. 8-oz. WS, 9-oz. HPM, 4 oz. LeMattia Injection Molding Machines. Accumulators. Laboratory Presses, Pistons & Oil Pumps. Pulverizers, Scrap Cutters, Grinders. Ball & Jewell, Cumberland. AARON MACHINERY CO., INC., 45 Crosby St., New York 12, N. Y. WOrth 4-8233.

WE HANDLE HYDRAULIC PRESSES, pumps, and power units of all sizes. Write us your requirements and we will try to help you. We find it impossible to list our equipment in this classified column due to the fact that the equipment is sold before ad is published. For those who seek action look in the New York Times under the Machinery and Tool Column for our regular Sunday Special. HYDRAULIC SAL-PRESS, INC., 386-90 Warren Street, Brooklyn 2, N. Y. MAin 4-7847.

FOR SALE: In excellent condition 96 inch Polyethylene Extrusion Die and 96 inch film wind-up machine and cooling trough. All equipment was made by Hartig Engine & Machine Company. Available for immediate shipment. Contact: KAYSON RUBBER & PLASTICS LIMITED, Galt, Ontario, Canada.

FOR SALE: 1—6"x12" Lab. Roller Mill; 1—Baker Perkins Banbury type 10 gal. Mixer, with pressure cover, m.d.; 4 Bolling 18"x18" 5-opening Hydraulic Presses; 2—Ball & Jewell Rotary Cutters; 1—100 gal. Patterson Kneadermaster S/S Mixer; 1—Eureka Rotary Cutter; 2—500 gal. Patterson Reaction jack. agit. Resin Kettles; 7—Dry Mixing Blenders, up to 11,000#; 1—NRM 1" electric heated Plastic Extruder; 2—Day Roball 82 Sifters, 40"x120" screens; 2—Rotex #12, 20"x37" screens; 1—Rotex 20"x48" Sifter; 3—Mikro Pulverizers 2TH, 3TH, 2DH. Also Grinders, Extruders, Compression and Injection Molding Presses, etc. Send us your Inquiries. Advise us what you have for sale. CONSOLIDATED PRODUCTS CO. INC., 13-14 Park Row, New York 38, N. Y. BArclay 7-0600.

FOR SALE: 1—Ball & Jewell No. 1½ Rotary Cutter, stainless steel. 4—Mikro Pulverizers #1-SH, #1-SI, #2-SI, #2-TH. 2—Kux Rotary Pellet Presses. 4—Stokes D-3 Rotary Pellet Presses. Read 600 lb. Jacketed Ribbon Mixer. Large stock Stainless Steel Tanks and Kettles. TERRY EQUIPMENT CORP., 1429 N. 6th St., Phila. 22, Pa.

PLASTIC MOLDING PLANT consisting of: Presses Tablet Machines, Tumblers, Molds, etc. Can be sold as complete plant or individual items. INDUSTRIAL PRODUCTS OF AMERICA, 140 Market St., Paterson, New Jersey.

GENERAL ELECTRIC MOTOR 25 H.P. 220-440 Volts, 60 cycles, Model 5K 1404AE1, 1170 R.P.M. Never used. Fits Reed-Prentice 8 oz. or 12 oz. machine. PREMIER PLASTICS CO., 905 Atlantic Ave., Bklyn.

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WANTED: Banbury Mixers, Heavy Duty mixers, Calenders Rubber Rolls & Mixers, Extruders, Grinders & Cutters, Hydraulic Equipment, Rotary and Vacuum Shelf Dryers, Injection Molding Machines. Will consider an operating or shut down plant. P.O. Box 1351, Church Street St., New York 8, N. Y.

WANTED OR WILL TRADE: Responsible Midwest Molder will either buy used 16 ounce—22 ounce or 24 ounce Reed-Prentice Injection Molding Press or will trade one brand new Reed-Prentice 12 ounce in a write-off deal for above equipment. Reply Box 405 MODERN PLASTICS.

WANTED: Plant or Machinery including Rubber Mills, Hydraulic presses, Sturdy mixers, Calenders, Banbury mixers, Pulverizers, Grinders, Rotary cutters, Extruders, Screens, Injection Molding machines, Dryers. CONSOLIDATED PRODUCTS CO. INC., 13-14 Park Row, New York 38, N. Y. BArclay 7-0600.

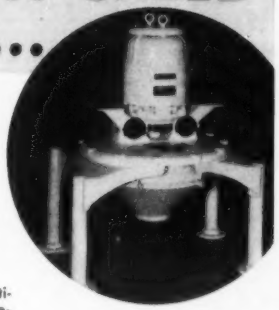
WANTED: TWO ROLL LAB MILL, suitable for processing vinyl plastic at 350° F. Must be suitable for use with steam at 50 lbs. pressure. Good price offered for machine in good running condition. Reply Box 408, MODERN PLASTICS.

WANTED: NEW OR USED 2½" or 3¼" N.R.M. extruders. Also parts such as cylinders, etc. ANCHOR PLASTICS CO., Telephone: RAvenwood 9-1494, Extension 1, Long Island City, N. Y.

WANTED: Plastic injection moulding machines. Get our offer before you sell. ACME MACHINERY & MFG CO., 102 Grove St., Worcester, Mass.

(*Continued on page 234*)

You save 6 ways with this HIGH SPEED MIXER...



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32 oz. CONC.—$5.85
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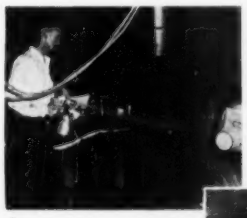
Molded Fiberglass made a revolutionary loudspeaker horn for Electro-Voice, Inc. of Buchanan, Michigan, with fidelity and sound range from 100 to 7000 cycles.

For four years we have been making better new products of molded fiberglass. Sometimes molded fiberglass parts are less expensive than parts they replaced, but always they are better.

Pictured here are several steps in the production of molded fiberglass parts. This new material and process can make better products for you.



Spraying binder and blowing fiberglass is an early step in building preform

Finished preform, with metal bead inserted in edge, is put into curing oven

Cured preform, removed from oven, is dropped into cast steel female cavity on the press

After weighed polyester resin has been added to the preform in the mold, pressure is applied

Using a lifting tool, operator removes finished speaker horn from the mold.

MOLDED FIBERGLASS COMPANY

ASHTABULA, OHIO

World's Largest Custom Molder of Molded Fiberglass

CLASSIFIED ADVERTISING

(Continued from page 232)

MATERIALS FOR SALE

FOR SALE: approx. 800 pounds 2 oz. 76 in. width full rolls Owens-Corning L. S. binder Fiberglas mat in new condition. Price 35¢ a pound F.O.B. metropolitan area, New York. Box 421, Modern Plastics.

ACETATE MOLDING POWDER: white, ivory, red, blue, green and pastel colors, 23¢ per pound F.O.B. New York immediate shipments from regular inventory. PEERLESS CHEMICAL CORP., 110 Bleecker Street, N.Y.C.-12.

FOR SALE: 85 Drums BECKAMINE P-613-40, .06 lb. CHEMICAL SERVICE CORP., 96-04 Beaver St., New York 5.

MATERIALS WANTED

WANTED: PLASTIC SCRAP OR REJECTS in any form. Also surplus and obsolete lots of virgin molding powders. We also custom reprocess your own scrap. A. BAMBERGER CORP., 702 Bedford Ave., Brooklyn 6, N. Y. Telephone: MAin 5-7450.

WANTED: Plastic Scrap, Rigid Vinyl, Cellulose Acetate, Polystyrene, Polyethylene, Butyrate. Custom grinding, magnetizing, compounding, and straining of contaminated plastics. FRANKLIN JEFFREY CORPORATION, 1671 McDonald Avenue, Brooklyn, N. Y., ES 5-7943.

EXTRUDING MACHINES and accessory parts for manufacturing of vinyl covered cord number 5 and number 7; and automatic molding injection machine 10 ounce or 12 ounce together with scrap grinder. Reply Box 410, Modern Plastics.

WANTED: THERMOPLASTIC SCRAP of any description. Excellent prices paid for your vinyl, acetate, butyrate, polystyrene, polyethylene, acrylic and nylon scrap or rejects in any form shape or color. Shipping to us is no more trouble than shipping to any U.S. point. For best prices for your plastic scrap contact: KAYSON RUBBER & PLASTICS LIMITED, Galt, Ontario, Canada.

WANTED: LUCITE & PLEXIGLASS—Surplus sheet stock, cut-offs, salvage and scrap. We deal only in acrylic sheets, rods and tubes and offer specialized attention to your inquiries. DUKE PLASTICS CORP., 406 Atlantic Ave., Brooklyn, N. Y. ULster 8-9413.

WANTED: PLASTIC SCRAP or REJECTS in any form: Cellulose Acetate, Butyrate, Polyethylene, Polystyrene, Vinyl, Acrylic, Ethyl Cellulose. Reply Box 406, Modern Plastics.

WANTED: Clear or Amber Ethyl Cellulose Scrap reground or shredded. Write Box 407, Modern Plastics.

WANTED: STYRENE PLASTIC SCRAP, ground or unground. Write Box 433, Modern Plastics, giving full particulars.

WANTED: SURPLUS UREA molding powder. Reply Box 409, Modern Plastics.

WANTED: PLASTIC SCRAP such as Cellulose Acetate, Vinyls, Acrylic, Ethyl Cellulose, Polystyrene, Butyrate, etc. We also buy surplus inventories of molding powder or grind, clean and reprocess your own scrap. CLAUDE P. BAMBERGER, INC., 152 Centre St., Brooklyn 31, N. Y., Tel. MAin 5-5553. Not connected with any other firm or similar name.

MOLDS FOR SALE

FOR SALE: Very cheap, 5 injection molds plus a good quantity of components. Molds are for a 3" round compact—a flat cigarette case—a square cigarette box—a piano cigarette box and a 16 cavity mold for midget wind-up cars. Prices and additional information upon request. Box 269, Dept. W, Erie, Pa.

TOY FIGURES: Eight multi-cavity molds consisting of forty-two different plastic toy figures. Molds in perfect running condition. Spray stencils also available for these figures. Suitable for small capacity mold machines. Reply Box 422, Modern Plastics.

MOLDS WANTED

MOLD WANTED for injection molding. We will buy one mold or a complete line or series of molds for finished resaleable items. Housewares, toys, novelties, etc. Will also buy molds for industrial parts such as handles, knobs, drawer pulls, gears. All items for resale in U. S. A. Send detailed information to VICTORY MANUFACTURING COMPANY, 1722 W. Arcade Place, Chicago 12, Illinois.

MOULDS FOR EYEGLASS, safety and sunglass frames. Photos of molds on request. This entire lot is priced for a quick sale. Reply Box 423, Modern Plastics.

PLANT FOR SALE

FOR SALE
Complete wood flour mill. Capacity 10 tons per 24 hours, using nearby supply of pine and poplar. For further particulars, reply Box 424, Modern Plastics

HELP WANTED

YOUNG TOOL ENGINEER: Are you looking for a real future with an established firm with an outstanding reputation? We want a smart aggressive man to work in the mold design and expediting branch of our Engineering Dept. Experience in the plastics industry is not essential but knowledge of drawing practice and tool making is important. Opportunity for advancement is excellent. Write or telephone Superintendent of Personnel, BOONTON MOLDING CO., Boonton, N. J. Phone—Boonton 8-2020.

EXTRUSION ENGINEER: Must be top notch man thoroughly qualified to take over polyethylene flat sheet extrusion operation. Must be able to improve existing equipment and design better equipment for the future. Attractive position with long-established Eastern extrusion company. All replies will be held in confidence. Give complete details on experience, qualifications, and salary requirements. Reply Box 412, Modern Plastics.

FOREMAN wanted for injection molding plant in Bridgeport, Connecticut, having 7 machines. Must be thoroughly experienced in all phases of molding, hot stamping, assembling, shipping, etc. Experienced in personnel management, maintenance, mold setup. Must be able to take complete charge of this department. Best working conditions, good pay. Give complete resume in first letter including references, wages expected. Plant has one room apartment. Also two night foremen needed. Telephone Fairfield 9-5219 or Bridgeport 8-1386. Firm in business 12 years, and growing.

TECHNICAL SALESMEN WANTED—Position open with large Midwest color manufacturer to head up color sales to the plastics and rubber industries. Must have some experience in the use of color in the plastics and rubber fields. Excellent opportunity for advancement in a new department. Reply Box 411, Modern Plastics.

ASSISTANT TO PLASTIC PRODUCTION Superintendent. Excellent opportunity for man thoroughly experienced in handling production personnel, supervising cost control systems, and possessing knowledge of methods used in large injection molding plants. Reply Box 431, Modern Plastics.

COMPOUNDING MANAGER: Capable man set up and manage compounding department. Also man to engineer dies, cost estimating, research development in small midwest plastic extrusion plant. Write full details. Reply Box 434, Modern Plastics.

PLASTICS ENGINEER—Diversification of extruded thermoplastic products line by well-established company located New Jersey metropolitan area creates excellent opportunity for man having some experience with rigid vinyls. Primary responsibility will be research and development. Please submit complete resume for prompt and confidential consideration. Reply Box 403, Modern Plastics.

INJECTION MOLDING FOREMAN Wanted by a progressive custom and proprietary molding plant in Richmond, Virginia area. Applicant must be accustomed to hard work and familiar with setting up molds, setting cycles, instructing others and handling all thermoplastics materials with emphasis on nylon. The man chosen will be a key member of our company and can look forward to an excellent financial and management growth potential with an aggressive, sound company. Send resume of your experience to Box 430, Modern Plastics.

CUSTOM MOLDING REPRESENTATIVE: Rapidly expanding Midwest Custom Injection Molding Company requires representation in all midwest industrial areas on commission basis. Have excellent assembly facilities which include all types of finishing, painting, and decorative work. Reply Box 401, Modern Plastics.

SALESMEN for fast growing midwest injection molder. Will consider man controlling one account or deal. Prefer man with experience in plastics and capable of giving some engineering service to customer. Applicant assured of excellent cooperation of plant equipped for volume molding, assembly, painting, etc. Men required in all industrial areas. Reply Box 402, Modern Plastics.

PROJECT ENGINEER
Major Midwest manufacturer has excellent opportunity for an aggressive man to participate in the development of high strength fibre glass plastics with immediate major emphasis upon cylindrical shapes. Preferably a Chemical Engineer with successful work experience in the development of glass and/or resins with emphasis on chemical composition, physical dimensions and surface finish of glass, the compounding of combinations of resins, wettings agents, curing, fibre pattern and impregnation of fibres. Some background experience or knowledge of machine design and product testing would be helpful. In addition, he should be able to effectively work with people and get maximum utilization of their abilities. He should also be able to direct cost study, analyze market conditions and properly evaluate the market ability and profit ability of the product. Replies held in confidence. Salary commensurate with ability and experience. Reply Box 439, Modern Plastics.

EXPERIENCED PLANT SUPERINTENDENT for fast growing Southern modern injection molding plant. One who is experienced in production procedures as well as compounding of plastic materials preferred. Write full past experience. Reply Box 415, Modern Plastics.

TECHNICIANS NEEDED: Two to five years experience in materials or plastics laboratroy. Will work under supervision of chemist or chemical engineer, in processing or application of plastic materials and etching and plating materials as well as testing materials used in the fabrication of electronic equipment. Write for employment application. Reply Box 438, Modern Plastics.

EXTRUSION OPERATOR wanted by Active New York City concern. Pleasant working conditions, Hospitalization benefits, 5 day week steady employment, overtime, advancement for right man. Must have experience with Acetate. Our help know of this advertisement. Write giving full details of experience. Reply Box 416, Modern Plastics.

PLANT MANAGER: Take complete charge of production of vinyl sheeting and extrusion operation in progressive, rapidly growing New England company. Unusual opportunity for right man. Reply Box 413, Modern Plastics.

EXTRUSION SALES MANAGER: Need salesman experienced in plastic extrusion products to take charge of sales of vinyl, polyethylene, and polystyrene shapes. Reply Box 414, Modern Plastics.

(Continued on page 236)

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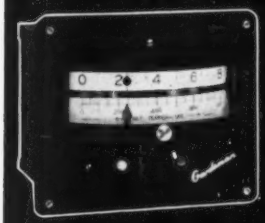

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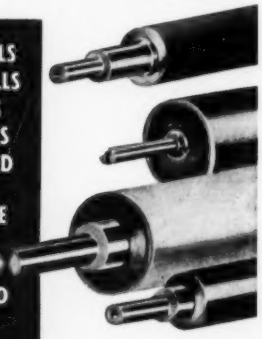

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CLASSIFIED ADVERTISING

(Continued from page 234)

SITUATIONS WANTED

SALES ENGINEER: age 33, currently selling molded and fabricated plastic components primarily to the electronic, television and aircraft manufacturing industry in metropolitan area for the past six years, seeking change. Will travel or relocate West Coast for right deal. Reply Box 436, Modern Plastics.

MOLDING ENGINEER. Interested in medium sized injection molding plant and participation as general manager. Ten years wide experience in sales, product development, assembly and finishing methods, injection mold design, cost control of proprietary and custom molded products. Reply Box 435, Modern Plastics.

PLASTIC EXTRUSION PLANT MANAGER—Chemical Engineer, 34, offers 12 years of diversified experience in management, research, production, and plant operation including complete knowledge of vinyl compounding, die designing, vinyl and polythene extrusion, purchasing, personnel training, new product development, and equipment selection and installation. Desires important position with a good future in a solid company. Reply Box 420, Modern Plastics.

PLASTICS ENGINEER: Varied experience in polyester-glass, vinyls and phenolics. Degrees in both chemistry and chemical engineering. Seeks responsible position along middle Atlantic Coast in development and/or technical service. Married. Available immediately. Reply Box 432, Modern Plastics.

TOP NOTCH SALESMAN. CHEMIST. Thorough knowledge vinyl plastic film production from raw materials thru printing & embossing finishes, seeks new connection with established vinyl film producer or investor desirous setting up sales & distributing organization. Box 750, 4 W. 40th St., New York 18, N. Y.

EXECUTIVE AVAILABLE: Presently employed as Plant Superintendent of medium size plant. Graduate Chemical Engineer; 23 years in Compression, Transfer, Injection Molding including supplementary operations. Qualified Plastics Engineer. Excellent record in the Development of Plastic Applications (including Nylon), Production Methods, Personnel Management, Estimating, Cost Control, etc. Desires permanent position offering greater opportunities. Married, excellent health, highly qualified references. Reply Box 428, Modern Plastics.

MANUFACTURER'S AGENT. Desires line of formed plastics including 3rd dimensional types. Has available automotive and appliance contacts Detroit and Michigan established over 15 years. Exclusive territory commission basis. E. H. Heck, 3460 AuDuBon Detroit 24, Michigan.

WELL ESTABLISHED manufacturers' representative of integrity, of more than 10 years' standing, desires an industrial line of injection, extruded and compression custom molding plastics for the greater Chicago area. Reply Box 437, Modern Plastics.

MISCELLANEOUS

MANUFACTURER WANTED—To manufacture and distribute the "Mobi" which clasps a woman's blouse within the waistband of the skirt, on a royalty basis to the patent holder. The "Mobi", made of acetate, invisible when worn, applies and detaches easily without concern to the size or material of blouse or skirt. Write for demonstration, giving business name, and address. Reply Box 419, Modern Plastics.

WANTED: PLASTICS MANUFACTURER FOR NEW, NON-COMPETITIVE bathroom item (Pat. Pend.) by nationally known inventor having more than 30 million of his devices in use. To be sold through a 5 & 10¢, drug, grocery chains and all independents. Jobber contact good, but not essential. Potential market several million a year. Royalty basis. Molder must assume cost of die approx. 7" by 5". Reply Box 417, Modern Plastics.

SWEDISH MANUFACTURER of polyethylene-bottles wishes to purchase the "know-how" of perfect printing on this material. Samples wanted. Reply Advertising Service Dept., Box 657, Stockholm 1, Sweden.

ATTENTION MOLDER-PRODUCERS. New inventions without rivals in today's market. Perfect for production in plastic. Saleable. Useful. Needed. COLLAPSIBLE HATSTAND: lightweight; open 73/4" high; closed, 1¼" x 3¼". Retailers want this item. INDIVIDUAL PIPESTAND for table, wall or car. Ashes cannot spill, pipe cannot fall nor burn surfaces. Hangs handily beside driver. Royalty basis or sell. "PAKA," 94 Eustis Ave., Newport, R. I.

IMPORTANT EUROPEAN CHEMICAL COMPANY needs engineer specialist to develop present plastic materials industry in Europe through purchase or introduction of new methods. Reply giving curriculum vitae. Reply Box 429, Modern Plastics.

ELECTROFORMED molds and paint masks. Economical and accurate. POINSETTIA, INC., Pitman 7, N. J.

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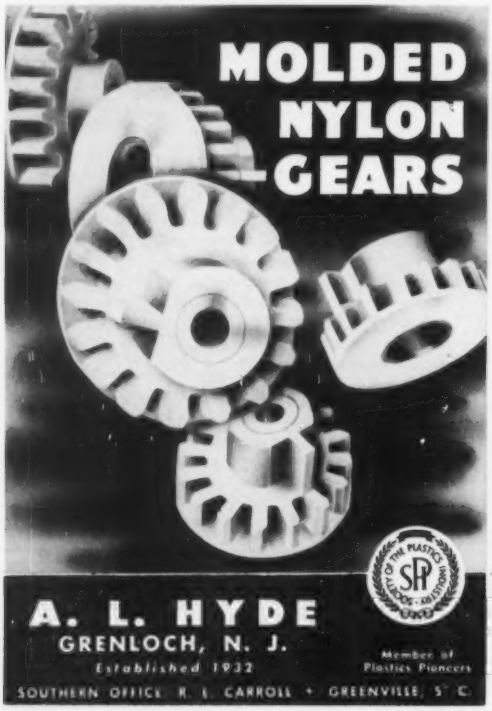
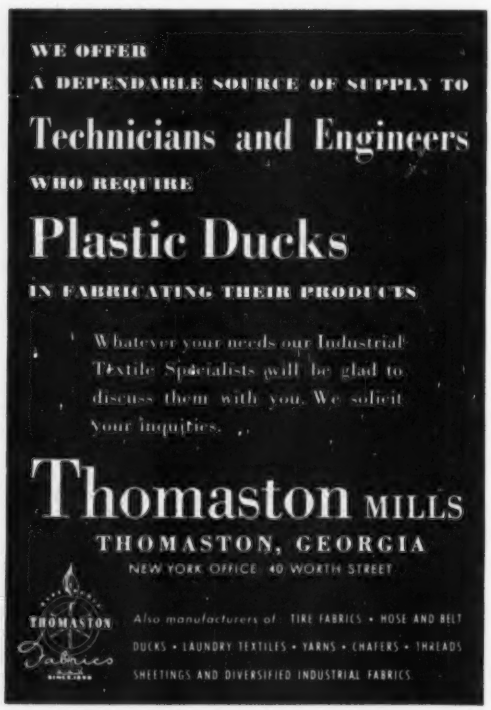
For further information address Classified Advertising Department, Modern Plastics, 575 Madison Avenue, N. Y. 22, N. Y.

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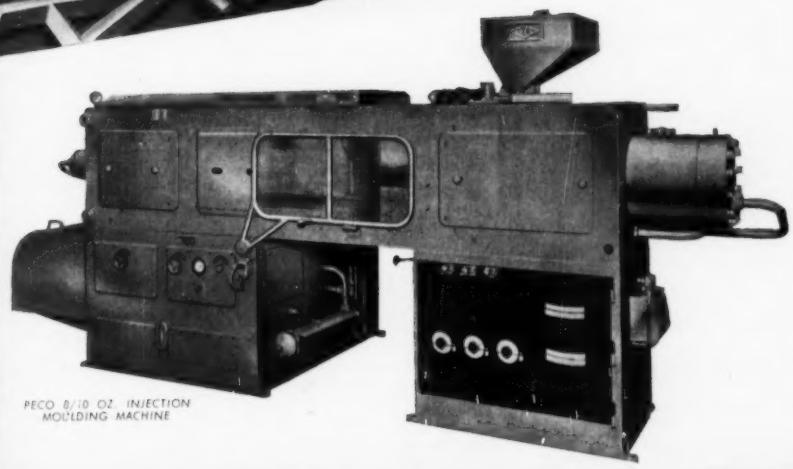

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MODERN PLASTICS

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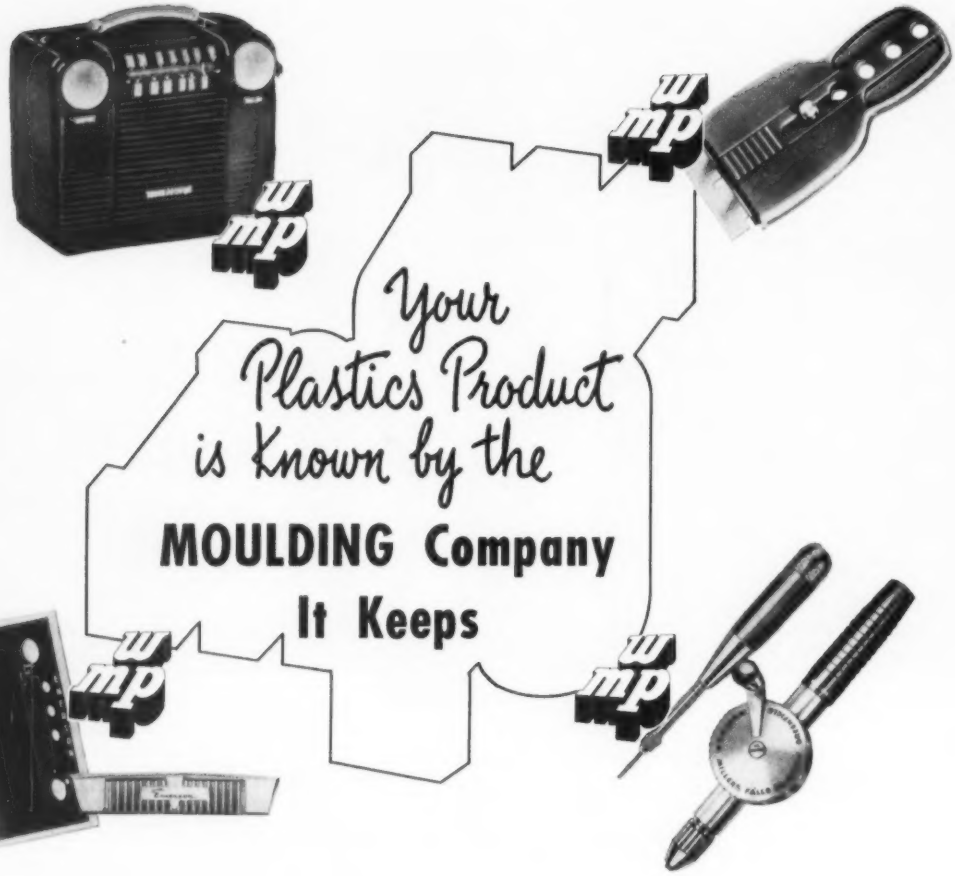

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All along the line — at the jobber, retailer and consumer levels — the quality of your component plastics parts can help — or hurt — your reputation and your sales. To be certain your plastics parts enjoy all the advantages of exceptionally high quality, choose a moulder with the experience, skill and facilities to work with you as your own moulding department.

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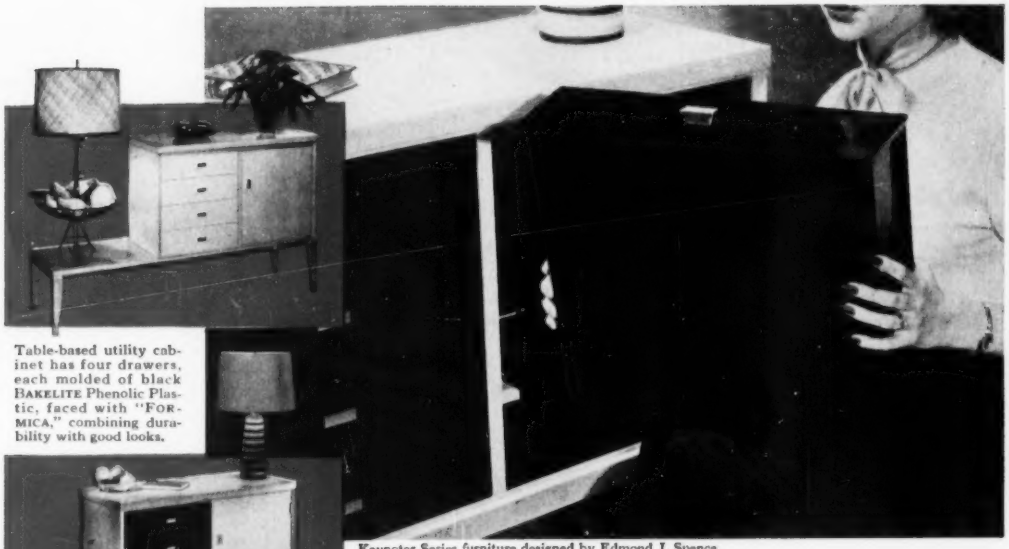
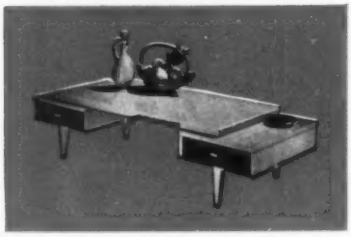


Table-based utility cabinet has four drawers, each molded of black BAKELITE Phenolic Plastic, faced with "FORMICA," combining durability with good looks.

Keynoter Series furniture designed by Edmond J. Spence for the Warren Furniture Manufacturing Co., Paterson, N. J.

Utility cabinet features four drawers of black BAKELITE Phenolic Plastic to complement an adjacent door of wood. They are easily cleaned, strong, smooth-working.



Adjustable cocktail table with two drawers of BAKELITE Phenolic Plastic, in rich self-contained ebony finish. They contrast handsomely with the soft-grained wood.

ONE-PIECE MOLDED PLASTIC DRAWER KEYNOTES NEWEST FURNITURE DESIGN

Designers of contemporary furniture are looking to contemporary materials to express their ideas. Latest proof of their success is this drawer molded of BAKELITE Phenolic Plastics.

It has several advantages over conventional drawers—in design, manufacture, and use. With its rounded corners and absence of seams, it's easier to clean. Precisely molded, smooth, light in weight, it fits perfectly in place, slides open quietly and effortlessly. It withstands moisture and heat — won't swell, crack, or warp in normal use. Fast mass-production keeps its cost low.

The drawer illustrated is a rich ebony black that harmonizes with the modern woods—ash-blond korina, limed oak, dark mahogany. It could also be molded in other colors, such as red, brown and simulated wood-effects. The soft satin finish is acquired in the molding operation. The drawer can also be faced with wood or other materials.

BAKELITE Phenolic Plastics have properties that inspire fresh, new designs. They are readily applied to the production of large-size moldings, of which cabinets for air conditioning units and television sets are typical. You, too, can profit through the use of these materials. BAKELITE engineers can help you. Write Dept. PH-13.

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Ventilating Fan Grille for kitchen use is made of BAKELITE C-11 plastic to resist cracking. C-11 also resists heat distortion, provides smooth surface and sharp detail. Molded by Hemco Plastics Div., Bryant Electric Co., Bridgeport 2, Conn.

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